

ANSWERS AND EXPLANATIONS1. *Ans. (d)*

Horizontal thrust

$$H = \frac{4EL \propto T}{\pi R^2}$$

2. *Ans. (b)*3. *Ans. (b)*4. *Ans. (a)*5. *Ans. (c)*6. *Ans. (c)*7. *Ans. (d)*8. *Ans. (b)*9. *Ans. (d)*10. *Ans. (b)*11. *Ans. (c)*12. *Ans. (c)*13. *Ans. (d)*14. *Ans. (b)*15. *Ans. (d)*16. *Ans. (d)*17. *Ans. (b)*

Single column manometer directly gives the pressure by measuring the height in the other limb and due to large cross-sectional area of the reservoir, for any variation in pressure, the change can be neglected.

18. *Ans. (a)*

$$Q = \frac{2}{3} C_d \times b \times \sqrt{2g} [(H_2)^{3/2} - (H_1)^{3/2}]$$

Here, $H_1 = 3.8$; $H_2 = 2.5$ and $b = 2.2$

$$Q = 13.9 \text{ m}^3/\text{sec}$$

19. *Ans. (b)*

Rubber, paints, polymeric solution, milk, paper pulp etc. are the example of pseudoplastic.

20. *Ans. (b)*

$$\text{Speed ratio} = \frac{u}{\sqrt{2gH}}$$

$$u = 0.48 \times \sqrt{2 \times 9.81 \times 256}$$

$$= 34.02 \text{ m/sec}$$

But $u = \left(\frac{\pi DN}{60} \right)$

$$D = \frac{60 \times 34.02}{\pi \times 630} = 1.03 \text{ m}$$

21. *Ans. (c)*

Reynold number is the factor by which type of flow is decided i.e., laminar or turbulent.

22. *Ans. (c)*

Always below the centroid of the area.

23. *Ans. (c)*

When a block of ice floating on water in a container melts, then the level of water will remains same in container.

24. *Ans. (b)*

Toricelli theorem is

$$V = \sqrt{2gH} \text{ for jet.}$$

25. *Ans. (c)*

Kinetic energy correction factor is

$$= \frac{1}{A} \int_A \left(\frac{v}{V} \right)^3 dA$$

26. *Ans. (a)*

In Acute angle adhesion is more than cohesion.

27. *Ans. (c)*

The method is very much useful for long curves and is generally used on highway curves when a theodolite is not available

$$\text{Length of chord} \approx \frac{R}{20}$$

Where, $R = \text{Radius of curve.}$

28. Ans. (c)

The horizontal distance between staff and instrument, D

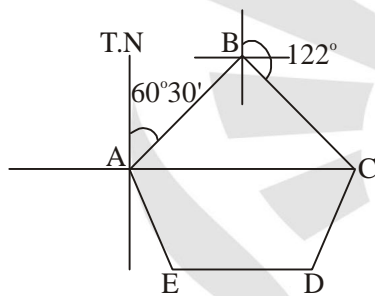
$$\begin{aligned}
 D &= KS + C \\
 \Rightarrow &= 100[2.83 - 1.726] + 0.4 \\
 \Rightarrow &= 100[1.104] + 0.4 \\
 \Rightarrow &= 110.8 \text{ m}
 \end{aligned}$$

29. Ans. (c)

Optical square : Optical square is used for setting out a line at right angles to another line. It consist of both horizon glass and index glass.

Box sextant : The box sextant is small pocket instrument used for measuring horizontal and vertical angles measuring chain angles and locating inaccessible point's.

30. Ans. (c)



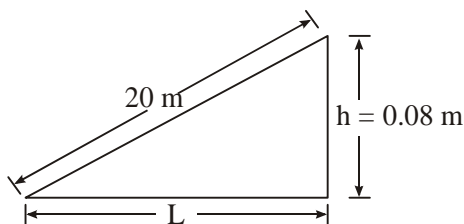
$$\begin{aligned}
 \text{F.B of AB is} &= 180^\circ + 60^\circ30' = 240^\circ30' \\
 \text{Included angle } \angle ABC \text{ is} &= 240^\circ30' - 122 = 118^\circ30'
 \end{aligned}$$

31. Ans. (d)

Correct sequence is in decreasing order of their accuracies.

- Microptic theodolite
- Prismatic compass
- Vernier theodolite
- Chain and metallic tape

32. Ans. (b)



Down hill end = 20 m

Slope = 20 m

height = 0.08 m

$$L^2 = (20)^2 - (0.08)^2$$

$$L = 19.984 \text{ m}$$

33. Ans. (b)

$$l = \frac{\pi R \Delta}{180} = \frac{\pi(5l)\Delta}{180}$$

$$\Delta = \frac{180l}{\pi 5l}$$

$$= \left(\frac{1}{5}\right) \text{ radius or } \frac{1}{10} \text{ radian}$$

34. Ans. (b)

$$185^\circ + 3.5^\circ - 1.5^\circ = 187^\circ$$

35. Ans. (c)

Weight gives information about the accuracy.

36. Ans. (d)

Value is 2.65 and 1.00

Least - Count = 0.01

$$\text{Maximum-error} = \frac{0.01}{2} = 0.005$$

Maximum probable is

$$= \frac{\text{Maximum error}}{2} = \frac{0.005}{2}$$

Maximum probable error

$$= 0.0025$$

37. Ans. (b)

As negative bending moment in restrained slab accrues at the corners, negative Reinforced is provided these.

38. Ans. (a)

39. Ans. (b)

For circular column it is $\rightarrow 6$

For Rectangular column it is $\rightarrow 4$

40. Ans. (d)

$$P_u = 0.40f_{ck}A_c + 0.67f_yA_{sc}$$

Minimum steel = 0.8% of gross area

$$A_{sc} = \frac{0.8}{100} \times 300 \times 300$$

$$= 720 \text{ mm}^2$$

$$A_c = (300 \times 300) - 720$$

$$= 89280 \text{ mm}^2$$

$$\rho_u = (0.40 \times 20 \times 89280)$$

$$+ (0.67 \times 415 \times 720)$$

$$\rho_u = 914436 \text{ N} = 914.44 \text{ kN}$$

Earth pressure at rest

$$K_o = \frac{u}{1-u}$$

$$K_o = 0.538$$

$$F_o = \frac{1}{2} K_o \gamma H^2 L$$

$$F_o = \frac{1}{2} \times 0.538 \times 20 \times 3^2 \times 5$$

$$F_o = 242.30 \text{ kN}$$

41. Ans. (a)

42. Ans. (c)

For beam, it is $\frac{85}{f_y}$ %

For slab, it is 0.12%

43. Ans. (b)

As per IS : 456 - 2000 (L.S.M.)

$$K_s = 0.25 \sqrt{f_{ck}}$$

As per IS : 456 - 1978 (W.S.M.)

$$K_s = 0.16 \sqrt{f_{ck}}$$

44. Ans. (c)

$$= \frac{2}{1+\beta}$$

$$\beta = \frac{\text{Longer side of footing}}{\text{Shorter side of footing}}$$

45. Ans. (d)

For steel = 1.15

For concrete = 1.5

46. Ans. (c)

For cohesive soils change in water content, changes it's state.

So, consistency as applied to cohesive soils is an indicator of its shear strength.

47. Ans. (d)

It is montmorillonite.

48. Ans. (b)

Kaolinite is electrically neutral.

Mica is closely associated to clay. 'Rock dust' is soil formed due to physical weathering.

49. Ans. (a)

Mass-Density

$$r_m = 20 \text{ kN/m}^3$$

Possion ratio = $\mu = 0.35$

50. Ans. (d)

Standard penetration test can be performed to determine

- Relative Density.
- Unconfined compressive strength.
- Angle of internal friction.

51. Ans. (b)

For $u = 50\%$

$$T_v = \frac{\pi}{4} u^2 = 0.196$$

$t = 2$ years

$$T_v = \frac{C_v t}{d^2}$$

$$0.196 = \left(\frac{C_v}{d^2} \right)^2 \quad \dots(1)$$

For $u = 40\%$

$$T_v = \frac{\pi}{4} \times (0.4)^2 = 0.1256$$

$$T_v = \frac{C_v t}{d^2}$$

$$0.1256 = 0.098 \times t$$

$t = 1$ year 3 month

52. Ans. (b)

For parallel flow

$$K_{eq} = \frac{K_1 h_1 + K_2 h_2 + K_3 h_3 + \dots}{h_1 + h_2 + h_3 + \dots}$$

$$K_{eq} = \frac{Kh + 2Kh + 3Kh}{h + h + h}$$

$$K_{eq} = \frac{6Kh}{3h}$$

$$K_{eq} = 2K$$

53. **Ans. (b)**
 Assumptions of bossinesque theory
- Homogeneous and isotropic
 - Hook's law void
 - Self weight neglected
 - Change in volume is neglected
 - Distribution of stresses along the vertical stresses is symmetrical

54. **Ans. (a)**
 $\Delta = 0.31 \text{ feet} = \Delta$
 Base period = 62 days = B

$$\text{Duty} = \frac{2.B}{\Delta} = \frac{2 \times 62}{0.31} = 400$$

$$= 400 \text{ Acre/Cusec}$$

55. **Ans. (c)**
 56. **Ans. (a)**
 57. **Ans. (d)**
 Ccheck-Dam is after storage structure.

58. **Ans. (a)**
 59. **Ans. (b)**
 60. **Ans. (c)**
 61. **Ans. (c)**
 62. **Ans. (d)**
 63. **Ans. (a)**
 64. **Ans. (a)**
 65. **Ans. (a)**
 66. **Ans. (b)**

67. **Ans. (a)**
 68. **Ans. (a)**
 69. **Ans. (b)**
 70. **Ans. (c)**
 71. **Ans. (b)**
 As per IS : 800 - 2007.

72. **Ans. (b)**
 73. **Ans. (b)**
 74. **Ans. (a)**
 As per IS : 800 - 2007

75. **Ans. (b)**

76. **Ans. (b)**
 77. **Ans. (b)**
 Maximum permissible bending stress = $0.75 f_y$.
 78. **Ans. (c)**
 79. **Ans. (c)**
 80. **Ans. (b)**
 It is bauschinger effect in mild steel.

81. **Ans. (c)**
 The diagonal is $B\sqrt{2}$. The location of maximum shear stress from neutral axis is $1/8\text{th}$ length of diagonal i.e., $\frac{B}{4\sqrt{2}}$.

82. **Ans. (c)**
 It is $e = \frac{b^2h^2t}{4I}$

83. **Ans. (b)**

$$\Delta = \frac{4PL}{\pi d_1 d_2 E}$$

$$= \frac{4 \times 20 \times 10^3 \times 800}{\pi \times 20 \times 40 \times 2 \times 10^4} = \frac{2}{5\pi}$$

84. **Ans. (d)**
 The forces are not concurrent so the resultant force and couple both may be present thus the best choice is that force are not in equilibrium.

85. **Ans. (d)**
 Deformation in the bar,

$$\Delta = \frac{wL}{AE}$$

- Strain energy = $\frac{1}{2} w\Delta = \frac{w^2L}{2AE}$

86. **Ans. (b)**

$$\frac{\phi_x 'y'}{2} = -\left(\frac{\epsilon_x - \epsilon_y}{2}\right) \sin 2\theta + \frac{\phi \times 4}{2} \cos^2 \theta$$

For $\theta = 45^\circ$ and $\phi_{xy} = 0$

$$\frac{\phi_x 'y'}{2} = -\left(\frac{\epsilon_x - \epsilon_y}{2}\right)$$

$$\phi_x 'y' = (\epsilon_x - \epsilon_y)$$

$$\phi_x 'y' = \epsilon_x - \epsilon_y \text{ (magnitude)}$$

87. *Ans. (d)*

$$\frac{T}{\tau} = \frac{\tau}{r} = \frac{N\theta}{L}$$

$$\tau_{\max} = \frac{T_r}{\tau}$$

$$f_s = \frac{Td/2}{\pi d^4/32} = \frac{16T}{\pi d^3}$$

$$d = 3\sqrt{\frac{16T}{\pi f_s}}$$

88. *Ans. (c)*

$$\mu = \frac{3K - 2G}{6K + 2G}$$

89. *Ans. (a)*

$$\frac{dv}{dx} = -w$$

and $\frac{dm}{dx} = v$

90. *Ans. (b)*

1.0

91. *Ans. (b)*

Putty is made up of powdered chalk and raw linseed oil.

92. *Ans. (b)*

Grade	Concrete Ratio Quantity	Water in litre
M10	1 : 3 : 6	34
M15	1 : 2 : 4	30
M20	1 : 1.5 : 3	27
M25	1 : 1 : 2	25

93. *Ans. (d)*

As fineness ↑, Specific surface area ↑, then rate of heat of solution ↑ so that rate of gain of strength increases with higher shrinkage.

94. *Ans. (b)*

As pozzoloric material increases the shrinkage value.

95. *Ans. (c)*

Clay imparts hydraulicity in hydraulic lime.

96. *Ans. (d)*

Crushing strength of stone depends on texture, specific gravity and type of stone.

97. *Ans. (a)*

Dressing of stone is done immediately after quarrying.

98. *Ans. (d)*

Poor or lean lime slakes very slowly because it consists more than 30% clay hence it is used for partition of wall.

99. *Ans. (d)*

Lower most horizontal piece is bottom rail in shutter.

100. *Ans. (c)*

Types of rocks	Example
Igneous rocks	Granite, dolerite, basalt and trap graves, sand stone, lime stone shale (clay stone), kankar gypsum
Metamorphic rocks	Marble, slate, graeiss, laterite, murum
Silicious rocks	Granite, quartzite, sand stone barsalt and trap, sinite
Argillicious rocks	Slate, laterite, kaoline, slaz, shale
Calcereous rock	Limestone, marbel, chalk, dolonrite

Types of Minerals Found	Example
Igneous rocks	Augite, olivive, feldspar, quartz, homblende, chlonite mica, serpentine
Sedimentary rocks	Calcite, glauconite, dolomite gypsum, limonite, anhydrate.

