

ANSWERS AND EXPLANATIONS1. **Ans. (c)**

For submerged soils, effective stress does not change with change in depth of water table.

2. **Ans. (c)**

I_c	Soil
< 0	Liquid
0 – 0.25	Very-soft
0.25 – 0.50	Soft
0.50 – 0.75	Medium stiff
0.75 – 1.00	Stiff
> 1	Very stiff

3. **Ans. (c)**

Clay has three types of mineral

- Kaolinite
- Illite
- Montmorillonite

4. **Ans. (d)**5. **Ans. (a)**

$$I_p = w_L - w_p$$

$$\text{Plastic limit} = w_L - I_p$$

With $w_L = \text{Constant}$

$$I_p = \text{Increasing}$$

$$w_p = \text{Decreasing}$$

It means soil is coarse, so permeability increase.

6. **Ans. (a)**

Montmorillonite shows the plastic behavior of soil. Specific gravity is property due to Iron and Mica.

7. **Ans. (b)**

As code is IS : 460 : 1962

8. **Ans. (d)**

Particle size analysis is ultimately shown by a curve between % fine (on y-axis) and size (on x-axis)

9. **Ans. (a)**

Black cotton soils show maximum volume change due to the mineral present in it that is montmorillonite.

10. **Ans. (c)**

An Isobar is a line which has points of equal vertical stresses.

11. **Ans. (a)**

$$V_n = \frac{V}{n}$$

Where,

$$V_n = \text{Seepage velocity}$$

$$V = \text{Discharge velocity}$$

$$n = \text{Porosity} = \frac{e}{1+e}$$

$$n = \frac{0.5}{1+0.5} = \frac{1}{3} = 0.33$$

$$V_n = \frac{6 \times 10^{-7}}{0.33} = 18 \times 10^{-7} \text{m/sec}$$

12. **Ans. (b)**

Mass specific gravity

$$\rho_m = 1.35$$

$$G = 2.7$$

Soil is dry

$$\text{So, } \rho_m = \rho_d = \frac{G\rho_w}{1+e}$$

$$1.35 = \frac{2.7 \times 1}{1+e}$$

$$e = 1$$

13. **Ans. (a)**

$$\text{Liquid limit} = 40\%$$

$$\text{Plasticity index} = 20\%$$

$$\text{Plastic limit} = \text{Liquid limit} - \text{Plasticity Index}$$

$$\text{Plastic limit} = 40\% - 20\% = 20\%$$

14. **Ans. (d)**

Shear failure of soils consists of

- Sliding of land mass
- Finite slope failure
- Failure of soil below building foundation.

15. **Ans. (a)**

For clay it is 16% – 17%

For silt it is 6% – 8%

For sand it is < 1%

16. *Ans. (a)*

$$\begin{aligned} \text{F.O.S} &= \frac{\tan \phi}{\tan \phi_m} \\ &= \frac{\tan 45^\circ}{\tan 30^\circ} = \frac{1}{1/\sqrt{3}} \\ \text{F.O.S.} &= \sqrt{3} = 1.732 \end{aligned}$$

17. *Ans. (a)*18. *Ans. (a)*19. *Ans. (c)*

As per IS : 800 - 2007 clause 3.7.2(c)

20. *Ans. (c)*21. *Ans. (d)*

$$k = \frac{3A_1}{3A_1 + A_2}$$

22. *Ans. (a)*

As per IS : 800 - 2007

23. *Ans. (d)*

Box section has maximum polar moment of inertia for the given area.

24. *Ans. (a)*25. *Ans. (b)*

For broad and meter gauge with single track impact factor

$$= 0.15 + \frac{8}{6+L}$$

Subjected to maximum of 'L'

For $L = 6 \text{ m}$

$$\text{Impact factor} = 0.15 + \frac{8}{12} = 0.82$$

So, for option, answer can be 0.75 (the closest one)

26. *Ans. (b)*

Effective length of weld = Total length - 2s

27. *Ans. (a)*28. *Ans. (c)*29. *Ans. (a)*

The accuracy is more in shop rivets than field rivets.

30. *Ans. (c)*

Throat thickness

$$t_t = \frac{l}{\sqrt{3}} s$$

$$\begin{aligned} \frac{\text{Size}}{\text{Throat - thickness}} &= \frac{s}{s/\sqrt{2}} \\ &= \sqrt{2} : 1 \end{aligned}$$

31. *Ans. (b)*

Lateral deflection are called "sway".

32. *Ans. (b)*For two hinged semicircular arch with load 'w' applied at any section, the radius vector θ with the horizontal.

$$H = \frac{w}{\pi} \sin^2 \theta$$

with load at crown.

$$\theta = \frac{\pi}{2}$$

$$\text{So, } H = \frac{w}{\pi}$$

33. *Ans. (c)*34. *Ans. (d)*

$$\Sigma f_x = 0; \Sigma M_x = 0$$

$$\Sigma f_y = 0; \Sigma M_y = 0$$

$$\Sigma f_z = 0; \Sigma M_z = 0$$

35. *Ans. (b)*36. *Ans. (a)*

Force or flexibility method cases redundant forces while stiffness or displacement method of analysis uses degrees of freedom.

37. *Ans. (a)*38. *Ans. (c)*

$$\text{Internal} = 3a$$

$$a = \text{Number of loops} = 0$$

$$\text{Internal} = 0$$

$$\text{External} = R - r$$

$$R = 3 + 3 = 6$$

$$r = 3$$

$$E = 6 - 3 = 3$$

Sq. static indeterminacy

$$S = I + E$$

$$= 0 + 3 = 3$$

39. *Ans. (b)*
40. *Ans. (c)*
28-days strength of concrete is 90% of its one year strength.
41. *Ans. (a)*
42. *Ans. (a)*
Air entrainment in concrete
- Reduces strength
 - Increases workability
43. *Ans. (c)*
Deflection is less in doubly beams as compared to singly Reinforced beams of same size.
44. *Ans. (d)*
When $\tau_v > \tau_{cmax}$
Diagonal compression failure occurs.
45. *Ans. (c)*
As per IS : 456 - 2000
 $L_p \text{ length} \geq L_d \text{ or } 24\phi$
46. *Ans. (d)*
All the factors affect bond strength.
47. *Ans. (b)*
As per IS : 456 - 2000, Clause 31.4.3.2
48. *Ans. (d)*
49. *Ans. (d)*
Due to unsymmetric section.
50. *Ans. (c)*
For beam, it is $\frac{85}{f_y} \%$
For slab, it is 0.12%