ANSWERS AND EXPLANATIONS

1. *Ans. (c)*

For 2D-rigid frame

$3m + r - 3j = 0$

$3m + r = 3j$

To be stable and determinate.

2. *Ans. (a)*

3. *Ans. (a)*

4. *Ans. (a)*

5. *Ans. (a)*

6. *Ans. (b)*

7. *Ans. (a)*

8. *Ans. (b)*

Torsional stiffness = $\frac{GI_p}{L}$

9. *Ans. (a)*

Due to twisting crystalline structure becomes more-dense.

10. *Ans. (c)*

It gives bending/flexural tensile strength $= 0.7\sqrt{f_{ck}}$

11. *Ans. (b)*

It's $0.03\% = \frac{0.03}{100} = 3 \times 10^{-4}$

12. *Ans. (b)*

13. *Ans. (c)*

It depends on grade of steel only.

14. *Ans. (b)*

As per IS : 456 - 2000

15. *Ans. (a)*

IS : 13920 $\rightarrow$ For earthquake resistant construction

IS : 1893 $\rightarrow$ To calculate earthquake forces.

16. *Ans. (d)*

17. *Ans. (c)*

For 90^o bend anchorage value is $8\ \phi$.

18. *Ans. (a)*

For deformed bars, it is 0.12%.

19. *Ans. (d)*

20. *Ans. (d)*

$$e_{min} = \frac{3000}{500} + \frac{300}{30} = 16 \text{ mm}$$

or $e_{min} = 20$ mm

21. *Ans. (a)*

Specific gravity

$G = 2.70$

$G_m = 1.84$

For dry soil $\rho_d = \frac{G\rho_w}{1+e}$

$$\Rightarrow \frac{\rho_d}{\rho_w} = \frac{G}{1+e}$$

$$\Rightarrow (G_m)_{dry} = \frac{G}{1+e}$$

$$\Rightarrow 1.84 = \frac{2.70}{1+e}$$

$$\Rightarrow e = 0.47$$

22. *Ans. (c)*

For plastic limit $\rightarrow$ 15 gm, 425 μ and for shrinkage limit $\rightarrow$ 30 gm, 425 μ.

23. *Ans. (b)*

24. *Ans. (b)*

It is more suitable for cohesionless soil, where entrapped soil can be removed easily.

25. *Ans. (c)*

26. *Ans. (a)*

Primary consolidation is the volume change of soil due to squeezing out of water from soil due to constantly application of load.

27. *Ans. (b)*

Maximum permissible shear-stress=45N/mm^2

Average shear-stress = 40 N/mm^2

28. *Ans. (c)*

$n = 1/3$

$$e = \frac{n}{1-n} = \frac{1/3}{1-1/3} = \frac{1}{2} = 0.5$$

$G = 2.5$

$$i_c = \frac{G-1}{1+e} = \frac{2.5-1}{1+0.5} = 1$$

29. ***Ans. (c)***

30. ***Ans. (a)***

Phreatic line is upper zone of saturation in earthen dams. It has atmospheric pressure (zero gauge - pressure) on it and it is a parabolic line.

31. ***Ans. (b)***

Sheep foot rollers are recommended for compacting cohesive soil.

32. ***Ans. (a)***

Dilatancy of soil shows the reaction to shaking.

33. ***Ans. (a)***

Heavy clay has least permeability. So, it has high OMC and less dry density.

34. ***Ans. (a)***

Meniscus correction = +ve

Temperature correction = ±ve

Dispersing agent correction = –ve

Net $C = +C_m - C_D \pm C_T$

35. ***Ans. (a)***

36. ***Ans. (c)***

- Wet clay → Grid Roller
- Crushed Rock → Smooth wheel Roller
- Fill Soil → Pneumatic tyred roller
- Sand → Vibrator

37. ***Ans. (b)***

Assumptions of boussinesq theory

- Homogeneous and isotropic
- Hook's law valid
- Self weight neglected
- Change in volume is neglected
- Distribution of stresses along the vertical stresses is symmetrical

38. ***Ans. (d)***

U-line is $I_P = 0.9(w_L - 8)$

A-line is $I_P = 0.73(w_L - 20)$

39. ***Ans. (d)***

40. ***Ans. (a)***

For rectangular section,

$$\text{Shape-Factor} = \frac{Z_p}{Z_e}$$

$$= \frac{BD^2/4}{BD^2/6} = \frac{3}{2} = 1.5$$

41. ***Ans. (d)***

42. ***Ans. (a)***

For yielding → Gross section

For Rupture → Net section

43. ***Ans. (b)***

It is taken as 0.7 – 1.0 times.

44. ***Ans. (a)***

45. ***Ans. (c)***

In this case 30^o slope is the best possible solution to minimize the wind force.

46. ***Ans. (b)***

47. ***Ans. (c)***

48. ***Ans. (a)***

As per IS : 800 - 2007

49. ***Ans. (b)***

50. ***Ans. (c)***