

ANSWERS

- 1.1. (b) 1.2. (b) 1.3. (a) 1.4. (b) 1.5. (b) 1.6. (d) 1.7. (c) 1.8. (d) 1.9. (d) 1.10. (c)
 1.11. (d) 1.12. (d) 1.13. (d) 1.14. (a) 1.15. (d) 1.16. (b) 1.17. (a) 1.18. (c) 1.19. (c)
 2.1. (a) 2.2. (a) 2.3. (d) 2.4. (a) 2.5. (c) 2.6. (c) 2.7. (c) 2.8. (d) 2.9. (d) 2.10. (c)
 2.11. (b) 2.12. (c) 2.13. (d) 2.14. (a) 2.15. (a) 2.16. (b) 2.17. (b) 2.18. (d) 2.19. (a) 2.20. (a)
 2.21. (*) 2.22. (d) 2.23. (b) 2.24. (c)

EXPLANATIONS

$$\begin{aligned}
 1.2 \quad \lim_{a \rightarrow \infty} \int_1^a x^{-1} dx &= \lim_{a \rightarrow \infty} \left[-\frac{1}{3} x^{-3} \right]_1^a \\
 &= \lim_{a \rightarrow \infty} -\frac{1}{3} [a^{-3} - 1] \\
 &= -\frac{1}{3} [0 - 1] = \frac{1}{3}
 \end{aligned}$$

$$\begin{aligned}
 1.3 \quad f(x) &= 1; -\frac{\pi}{2} < x < \frac{\pi}{2} \\
 &= 0; \text{ in other region} \\
 \therefore \frac{a_0}{2} &= \frac{1}{2\pi} \int_{-\pi/2}^{\pi/2} 1 dx = \frac{1}{2} \\
 a_n &= \frac{1}{\pi} \int_{-\pi/2}^{\pi/2} 1 \cos x dx = \frac{2}{n\pi} \sin \frac{n\pi}{2} \\
 b_n &= 0 \quad [\because f(x) \text{ is even function}] \\
 \text{Hence series is, } f(x) &= \frac{1}{2} + \sum_{n=1}^{\infty} \frac{2}{n\pi} \sin \frac{n\pi}{2} \cos nx
 \end{aligned}$$

$$1.5 \quad E.I = ML^{-1} T^2 \times L^4 = ML^3 T^2$$

1.6

In real beam	In conjugate beam
Fix-end	Free end
Internal hinge	Roller
Roller/Support	Internal hinge
Hinge	Hinge

1.8 The frame is statically determinate.
Taking moment about C, we have

$$R_A \times L + P \frac{1}{2} - P \frac{L}{2} = 0$$

$$\text{or} \quad \Rightarrow R_A = 0$$

1.12 Here $e = 0.5$

$$\therefore n = \frac{e}{1+e} = \frac{0.5}{1.5} = 33\%$$

$$\begin{aligned}
 1.13 \quad \gamma_{d1} &= 17 \text{ KN/m}^3 & V_1 &=? \\
 \gamma_{d2} &= 16 \text{ KN/m}^3 & V_2 &= 100 \text{ m}^3
 \end{aligned}$$

$$\therefore \gamma_{s1} = \frac{W_s}{V_s} = \frac{W_s}{V_1} \times \gamma_{d1};$$

$$\text{and} \quad \gamma_{s2} = \frac{W_s}{V_2} \times \gamma_{d2}$$

since γ_s is constant for a given soil, therefore

$$\frac{\gamma_{d1}}{\gamma_{d2}} = \frac{V_1}{V_2}$$

$$\text{or} \quad V_1 = \frac{17}{16} \times 100 = 106 \text{ m}^3$$

1.16 Here $D = 1428 \text{ hect/cum}$; $B = 120 \text{ days}$

$$\therefore \Delta = \frac{8.64B}{D} = \frac{8.64 \times 120}{1428} = 0.73 \text{ m}$$

1.17 For irrotational flow,

$$\text{vorticity, } \xi = \frac{\partial u}{\partial y} - \frac{\partial v}{\partial x} = 0$$