

CHAPTER - 11

WAVES

1. 4 $\text{Wave Velocity} = \frac{\omega}{k} = \frac{\pi/2 \times 100}{\pi} = 50$
 $\text{Max particle Velocity} = A\omega = 5 \times \pi/2 \times 100 = 250\pi$
 $\text{Ratio} = \frac{50}{250\pi} = \frac{1}{5\pi}$
2. 2 y_1 propagates in +x-axis and y_2 along -ve x-axis.
3. 4
4. 1 $A = 2 \text{ cm}$ $\lambda = 7.5 \text{ cm}$
 $k = 2\pi/\lambda = 0.84 \text{ cm}^{-1}$
 $v = \frac{1.2}{0.3} = 4 \text{ cm/s}$
 $\omega = v \times k = 3.36$
5. 4 $V_1 = \sqrt{\frac{T_1}{\mu}}$ $V_2 = \sqrt{\frac{T_2}{\mu}}$
 $\frac{V_1}{V_2} = \sqrt{\frac{T_1}{T_2}} = \sqrt{\frac{T}{2T}} = \frac{1}{\sqrt{2}}$

6. 3

$$v = f \lambda$$

$$v_1 = f \lambda_1$$

$$v_2 = f \lambda_2$$

$$\frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$$

$$\sqrt{\frac{T_1}{T_2}} = \frac{\lambda_1}{\lambda_2}$$

$$\sqrt{\frac{50}{200}} = \frac{\lambda_1}{\lambda_2}$$

$$\sqrt{\frac{1}{4}} = \frac{0.08}{\lambda_2}$$

$$\lambda_2 = 0.08 \times 2$$

$$= 0.16 \text{ m}$$

7. 1

$$A^2 = A_1^2 + A_2^2 + 2 A_1 A_2 \cos \phi$$

$$= A^2 + A^2 + 2 A A \cos \frac{\phi}{2}$$

$$= 2 A^2 + 2 A^2 \cos \frac{\phi}{2}$$

$$= 2 A^2 \left(1 + \cos \frac{\phi}{2} \right)$$

$$= 2 A^2 \times 2 \cos^2 \frac{\phi}{4}$$

$$A' = 2 A \cos \frac{\phi}{4}$$

8. 4

9. 4

$$P_i = 2 \pi^2 f^2 A_i^2 \mu_1 v_1$$

$$P_{\text{ref}} = 2 \pi^2 f^2 A_{\text{ref}}^2 \mu_1 v_1$$

$$A_{\text{ref}} = \frac{v_2 - v_1}{v_2 + v_1} A_i = \frac{\sqrt{\frac{T}{4\mu}} - \sqrt{\frac{T}{\mu}}}{\sqrt{\frac{T}{4\mu}} + \sqrt{\frac{T}{\mu}}} A_i = -\frac{A_i}{3}$$

$$P_{\text{ref}} = 2 \pi^2 f^2 \frac{A_i^2}{9} \mu_1 v_1$$

$$P_{\text{ref}} = \frac{P_i}{9}$$

$$\therefore P_t = \frac{8 P_i}{9} \quad \frac{P_t}{P_i} = \frac{8}{9}$$

10. 1

11. 2
$$L = 5 \frac{\lambda}{2} \Rightarrow 10 = 5 \frac{\lambda}{2} \Rightarrow \lambda = 4\text{m} \therefore f = \frac{v}{\lambda} = \frac{20}{4} = 5\text{Hz}$$

12. 1

$f\lambda = \text{const}$
 $\lambda_1 : \lambda_2 : \lambda_3 = \frac{1}{f_1} : \frac{1}{f_2} : \frac{1}{f_3} = 1 : \frac{1}{2} : \frac{1}{3} = 6 : 3 : 2$
 $\lambda_1 = 6\text{ k} \quad \lambda_2 = 3\text{ k} \quad \lambda_3 = 2\text{ k}.$
 $6\text{ k} + 3\text{ k} + 2\text{ k} = 1.10 \quad k = 0.1\text{ m}$

13. 1

$v = f_1 \lambda_1 \quad 50 = f_2 \lambda_2$
 $\Rightarrow f_1 - f_2 = \frac{v}{\lambda_1} - \frac{v}{\lambda_2} = 0.1 \Rightarrow v = 255 \text{ m/s}$

14. 3

$v = f\lambda \quad (\lambda/4 = L) \Rightarrow 336 = 20 \cdot 4L \Rightarrow L = 4.2 \text{ m}$

15. 4

$I = 10 \log(I/I_0)$
 $90 = 10 \log(I_1/I_0)$
 $40 = 10 \log(I_2/I_0)$
 $50 = 10 \log(I_1/I_0) - 10 \log(I_2/I_0)$
 $50 = 10 \log I_1/I_2$
 $I_1/I_2 = 10^5$

16. 2

17. 2

18. 8

19. 2

20. 3

$$f \propto \sqrt{T}$$

$$f' \propto \sqrt{1.01T}$$

$$\frac{f'}{f} = \sqrt{1.01} = (1+0.01)^{1/2} = 1 + \frac{1}{200}$$

$$\text{Beat freq } f' - f = \frac{f}{200} = \frac{200}{200} = 1$$

1 beat in 1 sec.

\therefore 30 beat in 30 sec

$$\therefore \begin{aligned} 10\eta &= 30 \\ \eta &= 3 // \end{aligned}$$

PART - II (JEE ADVANCED LEVEL)

21. C

22. A

23. BD

24. ABD

25. BCD

26. BC

27. (A-P), (B-R,S), (C-Q,T), (D-P,R)

28. (A-P,R,S,T), (B-S,T), (C-Q,S,T), (D-P,R,S,T)