

2026

(Regular)

Physics (Core)

Paper Code : PY-CE-4224

Paper Name : Waves & Applied Optics

Time : 2 hours

Full Marks : 45

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : 1×4=4
 - a) What is the restoring force in a ripple wave ?
 - b) Define group velocity.
 - c) Why stimulated emission is necessary for laser action ?
 - d) What is population inversion ?
2. Answer the following questions : 2×3=6
 - a) How does temperature effect velocity of sound in a medium?
 - b) Number of intersections made by a Lissajous figure with x-axis and y- axis are 2 and 6 respectively. If the frequency applied along y-axis is 410 Hz, what is the frequency along x- axis?
 - c) What is resonance ? What is sharpness of resonance ?
3. Answer *any three* questions from the following : 5×3=15
 - a) Derive an expression for resultant vibration due to superposition of two simple harmonic motions of same frequency, different amplitude and a phase difference of 90° .
5
 - b) Deduce Newton's formula for velocity of sound. Discuss Laplace's correction. 3+2=5
 - c) A sinusoidal wave on a string is described by :
$$y(x,t) = 0.02 \sin(4x - 50t) \text{ (SI Units)}$$

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- i) Find the wave speed v , wavelength λ and frequency f of the wave. 3
- ii) If the string has a linear mean density $\mu = 0.1 \text{ kg/m}$, calculate the tension in the string. 2
- d) Describe construction and working of a Ruby laser with necessary diagram. 5
- e) What is optical fibre ? Explain how light propagates through optical fibre. 1+4=5
- f) Discuss the formation of stationary waves in open pipe and obtain the possible modes of vibration. 5
4. Answer **any two** questions from the following : 10×2=20
- a) Mention properties of a good auditorium. What is reverberation? Derive Sabine's law for reverberation time in acoustics. 2+1+7=10
- b) What is free vibration ? Obtain an equation for i) overdamped and ii) critically damped vibration.
What is forced vibration ? 1+4+4+1=10
- c) Derive the differential form of wave equation. Show that the displacement wave is out of phase with pressure wave by 90° . Show it by suitable diagram. 3+6+1=10
- d) Explain principle and theory of holography. Describe different types of holograms. Mention applications of holography in character recognition. 4+2+2+2=10

