

B.Sc. Second Year (CBCS Pattern) Semester-IV
USPHT07 - Physics Paper-I - Waves, Acoustics & Laser

P. Pages : 2

Time : Three Hours



GUG/S/25/12016(S)

Max. Marks : 50

- Notes :
1. All questions are compulsory.
 2. Draw neat and well labelled diagrams if necessary.
 3. Scientific calculator is allowed.

Either :

1. A) i) What is Lissajous figure? Derive an expression for the resultant of two simple harmonic motion of equal frequency with different amplitude and having a phase difference of ϕ . When they act at right angle to one another. 6
- ii) Discuss and find the Lissajous figures for $\phi = 0$ and $\phi = \pi/2$ 4

OR

- B) a) Show that the resultant of two SHMs at right angle to each other having equal period and equal amplitude but phase difference of $\pi/2$ is a circle. 2½
- b) Explain principle of superposition. Write the conditions for beat formation. 2½
- c) Discuss the method to determine unknown frequency of AC source using method of Lissajous figure by CRO. 2½
- d) Calculate the velocity of sound in air in which the waves of wavelength 60cm and 60.7cm produce 8 beats per second. 2½

Either :

2. A) i) Discuss the difference between progressive wave and standing wave. 3
- ii) Deduce wave equation for standing wave on stretched string. 3
- iii) Define group velocity and wave velocity-Derive the relation between them. 4

OR

- B) a) Write Fourier's theorem. Mention its limitation. 2½
- b) Evaluate the coefficients A_n and B_n in Fourier series. 2½
- c) Explain the normal modes of vibration of string. 2½
- d) Find the amplitude, frequency, velocity and wavelength of transverse wave in string represented by $y = 5 \sin 2\pi(t - 0.04x)$ in SI unit. 2½

Either :

3. A) i) What are ultrasonic waves? Explain with diagram the piezoelectric method to produce ultrasonic wave. 5

- ii) What is reverberation time? Derive Sabine's formula for reverberation and explain its significance. 5

OR

- B) a) Distinguish between noise and music. 2½
- b) Write the requirement of good auditorium. 2½
- c) Describe the different characteristics of musical sound. 2½
- d) A class room of size $5 \times 6 \times 10$ meters and has reverberation time. of 1.6 sec. Find the total sound absorption of the class room. 2½

Either :

4. A) i) What is LASER? Explain the construction and working of Ruby laser with suitable diagram. 6
- ii) Write construction and working of He-Ne laser. 4

OR

- B) a) Explain temporal coherence and spatial coherence. 2½
- b) Why does the population inversion required in laser? 2½
- c) Write short notes on semiconductor laser. 2½
- d) The wavelength of emission is 6000 \AA and life time T_{sp} is 10^{-6} S . Determine the coefficient for the stimulated emission. 2½

5. Attempt **any ten** questions.

- a) Write any two application of beat. 1
- b) Write factor on which the shape of Lissajous figures depends. 1
- c) Write any two application of Lissajous figure. 1
- d) What is wave intensity? 1
- e) Write the application of Saw tooth wave. 1
- f) Find the speed of propagation of transverse wave on wire of mass per unit length is $3.0 \times 10^{-3} \text{ kgm}$. which is under a tension of 700N. 1
- g) What Bel and Decibels? 1
- h) What is an Echo? 1
- i) Write the applications of ultrasonic wave. 1
- j) What is optical pumping? 1
- k) What are application of laser in medicine? 1
- l) Define stimulated emission. 1
