

B.Sc. S.Y. (CBCS Pattern) Sem-IV
USPHT07 - 11 - Physics Paper-I : Waves, Acoustics & Laser

P. Pages : 2

Time : Three Hours



GUG/W/22/12016

Max. Marks : 50

- Notes : 1. All questions are compulsory.
2. Draw neat labelled diagrams whenever necessary.

Either:

1. a) i) What are beats? Give analytical treatment for beats and show that number of beats produced per second is equal to the difference in the frequencies of two SHMS. 4
ii) Two tuning forks produces 4 beats per second when sounded together. One of them is in unison with 1.20m length of wire and the other with 1.25m of it. Calculate the frequencies of forks. 3
iii) Use graphical analysis of find resultant of two SHMS travelling in perpendicular directions having different amplitudes, frequencies in the ratio 1 : 1 and phase difference $0, \frac{\pi}{2}$ and π 3

OR

- b) a) Explain the formation of Lissajous figures using C.R.O. 2 ½
b) Analytically find the expression for resultant of two SHMS having different amplitudes, phase difference ϕ between them and frequencies in the ratio 1:1 and travelling in perpendicular directions. 2 ½
c) Find the expression for resultant of two SHMS having diff amplitudes, phase difference ϕ and frequencies in the ratio 2:1 travelling in perpendicular directions. 2 ½
d) Discuss the special cases when $\phi = 0, \pi/4, \pi/2, \pi$ for above. 2 ½

Either:

2. a) i) State and explain Fourier's theorem. 3
ii) Find the expressions for Fourier coefficients A_0, A_r and B_r 3
iii) Explain how Fourier theorem is applicable for saw tooth wave form. 4

OR

- b) a) Explain the difference between progressive waves and standing waves. 2 ½
b) Derive an expression for velocity of propagation of transverse waves along a stretched string. 2 ½
c) Define group velocity and phase velocity and derive the relation between two. 2 ½
d) Discuss different modes of vibration along a stretched string. 2 ½

Either:

3. a) i) What are ultrasonic waves? Explain the formation of ultrasonic waves using piezoelectric effect. 4
ii) Discuss different applications of ultrasonic waves. 3

- iii) A quartz crystal of thickness 1×10^{-3} m is vibrating at resonance. Calculate the fundamental frequency. 3
 (given $\gamma = 7.9 \times 10^{10}$ N/m² $\rho = 2650$ kg/m³)

OR

- b) a) Establish Sabines formula for reverberation time. 2 ½
 b) Write short notes on pitch quality echo, loudness and intensity. 2 ½
 c) Distinguish between noise and musical sound. 2 ½
 d) Explain the requirements of good auditorium. 2 ½

Either :

4. a) i) What is LASER mention the characteristics of Laser beam. 3
 ii) A laser beam has wavelength of 8×10^{-7} m and aperture 5×10^{-3} m. It is sent to moon. 3
 The distance of moon is 4×10^5 km from earth. Calculate the angular spread of beam and axial spread when it reaches the moon.
 iii) Explain construction and working Ruby Laser. 4

OR

- b) a) Write short notes on stimulated emission and spontaneous emission. 2 ½
 b) Explain different applications of Laser. 2 ½
 c) The coherence length for sodium light is 2.945×10^{-2} m. The wavelength of sodium light is 5890 Å. Calculate the number of oscillations corresponding to the coherence length and the coherence time. 2 ½
 d) Explain the working of semiconductor laser. 2 ½

5. Solve **any ten** of the following.
- a) State principle of superposition of waves. 1
 b) What are Lissajous figures? 1
 c) Write applications of Lissajous figures. 1
 d) Mention limitations of Fourier's theorem. 1
 e) Write the conditions for nodes and antinodes in standing waves. 1
 f) Define reverberation time. 1
 g) Define absorption coefficient 1
 h) Mention characteristics of ultrasonic waves. 1
 i) What is bel and decibel? 1
 j) What is population inversion? 1
 k) What is temporal coherence? 1
 l) What is Ne-He Laser? 1
