

B.Sc. Second Year CBCS Pattern Semester-IV
USPHT07 - Physics Paper-I : Waves, Acoustic & Laser

P. Pages : 3

Time : Three Hours



GUG/W/23/12016

Max. Marks : 50

- Notes : 1. All questions are compulsory.
2. Draw neat and labelled diagram wherever necessary.

Either:

1. a) i) What are beats? 1
- ii) Derive an expression for the resultant motion of the particle, when two simple harmonic motions having slightly different frequencies and are in same phase along the same line. 3
- iii) Find the resultant of two simple harmonic motion at right angles to each other having period in the ratio 1:1, different amplitudes and phase difference of 0 or π radian between them. 5
- iv) Calculate the number of beats heard per second if there are two sources of sound of frequencies 400 Hz and 402 Hz at equal intensity sounded together. 1

OR

- b) a) What are Lissajous's figures? Explain the formation of Lissajous's figures by CRO. 2½
- b) Derive an expression for the resultant at superposition of two perpendicular harmonic oscillations with 1:2 frequency ratio. 2½
- c) Explain the applications of Lissajous's figures to determine unknown frequency. 2½
- d) Explain Graphically the resultant of two S.H.M. of same frequency acting at right angle to each other with a phase difference of $\pi/2$. 2½

Either:

2. a) i) Define the term phase velocity and group velocity. Derive the relation between the two. Does the group velocity is always less than the phase velocity. 4
- ii) Derive an expression for velocity of transverse waves along a stretched string. 4
- iii) A stretched string with a tension of one Newton has 0.2 gm mass/cm length. Find the velocity of the waves in it. 2

OR

- b) a) Evaluate the various co-efficient in Fourier Series. 2½
- b) Using Fourier theorem analyze a saw toothed wave. 2½

- c) Find the Fourier Series to represent $f(x) = |x|$, $-\pi < x < \pi$. 2½
- d) State the limitations of Fourier Theorem. 2½

Either:

3. a) i) What are ultrasonic waves. How are they can be detected? 3
- ii) State Piezoelectric effect. Explain the production of Ultrasonic waves using piezoelectric effect. 4
- iii) Calculate the fundamental frequency of Ultrasonics produced by quartz crystal of thickness 0.5 mm. The value of Young's modulus for quartz is 8×10^{11} dyne / cm² and density 2.65 gm / cm³. 3

OR

- b) a) Deduce Sabine's formula for reverberation time. 2½
- b) What are the characteristics of good auditorium. 2½
- c) The volume of the hall is 45,000 m³ having reverberation time 1.5 sec. What is the total absorbing power of the surfaces in the hall, if the area of the sound absorbing surface is 8,000 m². Calculate the average absorption coefficient. 2½
- d) Explain the characteristics of Musical Sound. 2½

Either:

4. a) i) Explain construction and working of He – Ne Laser. 4
- ii) Explain the difference between spontaneous and stimulated emission. 3
- iii) A perfectly monochromatic continuous laser beam chopped into 0.1 ns pulses using short shutter. 3
Calculate the coherence length and bandwidth.

OR

- b) a) Explain the working of Ruby Laser. 2½
- b) State the characteristics of Laser beam. 2½
- c) Explain in brief the term optical pumping and population inversion. 2½
- d) What do you mean by coherence? Discuss temporal coherence and spatial coherence. 2½

5. Solve **any ten** of the following.
- a) Define simple harmonic motion. 1
 - b) State the principle of superposition of two waves. 1
 - c) What are the applications of beats? 1
 - d) Define 'Standing wave'. 1
 - e) Define progressive wave and state its equation. 1
 - f) What is Bel and Decibel? 1
 - g) Define Intensity and loudness of sound. 1
 - h) State the difference between Noise and Music. 1
 - i) What are node and antinode in standing wave. 1
 - j) State the applications of Laser. 1
 - k) What are the characteristics of LASER beam? 1
 - l) What is metastable state? 1
