

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

P. Pages : 3

Time : Three Hours



GUG/W/24/12016(S)

Max. Marks : 50

Either:

1. a) i) Find the resultant of two simple harmonic motions of equal frequency when they act at right angles to one another. Discuss different important cases. **6**
- ii) Explain the formation of Lissajous figure by CRO. **2**
- iii) Lissajous' figures are produced with two tuning forks whose frequencies are approximately in the ratio 2:1. It takes 6 seconds to go through a cycle of changes. On loading slightly, the fork of the higher pitch with was, the period of cycle is raised to 10 second. If the frequency of the lower fork is 150, what is the frequency of the other fork before and after loading? **2**

OR

- b) a) State the principle of superposition of waves? What are the conditions for interference of Sound? **2½**
- b) Show that the frequency of beats is equal to the difference in frequencies of the sounding bodies with the help of Superposition of two SHMs. **2½**
- c) What is Lassajous' Figure? State the applications of Lissajous's figure. **2½**
- d) Two tuning Fork A and B produce the beat of frequency 8. If frequency of Fork A is 260 Hz then find the possible frequency of fork B. **2½**

Either:

2. a) i) State the characteristics of Stationary waves. **2**
- ii) Derive wave equation of standing waves on a stretched string. **4**
- iii) Define phase velocity and group velocity. Obtain the relationship between phase Velocity and group velocity. **4**

OR

- b) a) What is progressive wave? Derive an equation of velocity of transverse waves on stretched string. **2½**
- b) State Fourier's Theorem and give its coefficients a_0, a_n and b_n . **2½**

- c) State the limitations of Fourier theorem. 2½
- d) A sonometer wire of linear density 0.002 kg/m is applied by a tension 20N. The resonating length of the wire is 0.125m. It produces 8 beats per sec with a tuning fork, if the vibrating length of the wire is changed by a small amount. Compute the frequency of fork. 2½

Either:

3. a) i) What is ultrasonic waves? 1
- ii) State characteristics of ultrasonic waves. 2
- iii) What is piezo-electric effect? Explain the production of ultrasonic waves using piezo-electric crystals. 5
- iv) Calculate the fundamental frequency of ultrasonic produced by quartz crystal of thickness 0.5mm. The value of Young's modulus for quartz is 8×10^{11} dynes/cm² and density 2.65 gm/cm³. 2

OR

- b) a) What is reverberation and reverberation time? 2½
- b) Explain Intensity and loudness of sound. 2½
- c) Give the requirements of good auditorium. 2½
- d) What is musical scale? Define any two terms related to musical scale. 2½

Either:

4. a) i) What is coherence? Explain Temporal coherence and Spatial coherence. 4
- ii) Explain the construction and working of Ruby laser by drawing suitable diagrams. 5
- iii) For a source radiating at mean wavelength 6000Å, the coherence time is 2×10^{-10} sec. Determine coherent length. 1

OR

- b) a) Explain stimulated emission. 2½
- b) Explain the population inversion. 2½
- c) State the applications of laser. 2½

- d) Imagine that we chop a continuous laser beam (assumed to be perfectly monochromatic $\lambda_0 = 623.8\text{nm}$) into 0.1ns pulses using some sort of shutter. 2½

Compute the coherence length and band width.

5. Attempt **any ten** questions from the following.

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| a) | Define SHM. | 1 |
| b) | What are Beats? | 1 |
| c) | Calculate the number of beats heard per second when two sound of frequencies 400Hz and 402Hz of equal intensity sounded together. | 1 |
| d) | What are nodes and antinodes? | 1 |
| e) | What is harmonic and overtone? | 1 |
| f) | Define transverse waves. | 1 |
| g) | What is infrasonic and ultrasonic waves? | 1 |
| h) | What is noise? | 1 |
| i) | What is Pitch? | 1 |
| j) | What is LASER? | 1 |
| k) | State types of lasers. | 1 |
| l) | Write any two characteristic of LASER. | 1 |
