

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

Max. Marks : 50

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

Either:

1. a) i) What are Lissajou's figures? Mention its applications. 2
- ii) Obtain an expression for resultant of two S.H.M.s moving in directions perpendicular to each other having same frequencies, different amplitudes and phase difference ϕ between them. Hence find Lissajou's figures for $\phi = 0, \pi/2$ and π . 6
- iii) Discuss optical method of obtaining Lissajou's figures. 2

OR

- b) a) Two tuning forks A and B have nearly equal frequencies. Their resultant pattern repeats after every 25 seconds. When A is slightly loaded, the pattern repeats after every 10 seconds. If frequency of B is 300 Hz, find the frequency of A before and after loading. 2½
- b) Give graphical analysis of Lissajou's figures for two S.H.M.s having different amplitudes, frequencies in the ratio 1:2 and phase difference $\pi/4$ between them. 2½
- c) Give analytical treatment of beats and find the conditions for maximum and minimum amplitudes. 2½
- d) With proper diagram explain formation of Lissajou's figures using C.R.O. 2½

Either:

2. a) i) State Fourier's theorem and mention the conditions under which it holds good. 2
- ii) Evaluate various Fourier's coefficients. 5
- iii) Obtain the Fourier's series for a complex periodic function given by $y = a$ from $t = 0$ to $T/2$ and $y = 0$ from $t = T/2$ to T . 3

OR

- b) a) Derive an expression for the velocity of transverse waves in stretched uniform string. 2½

- b) Define phase velocity and group velocity and derive the relation between the two. 2½
- c) Write short note on different modes of vibrations of strings. 2½
- d) Differentiate between progressive wave and stationary waves. 2½

Either:

- 3. a) i) What are ultrasonic waves? Mention its properties. 3
- ii) What is Piezoelectric effect? Explain production of ultrasonic waves using piezoelectric effect. 5
- iii) Explain the applications of ultrasonic waves. 2

OR

- b) a) Explain the characteristics of musical sound. 2½
- b) Write a short note on musical scale. 2½
- c) A hall of volume 5500 meter³ is found to have a reverberation time of 2.3 seconds. The sound absorbing surface of the hall has an area of 750meter². Calculate the average absorption coefficient. 2½
- d) Explain the requirements of good Auditorium. 2½

Either:

- 4. a) i) Explain the terms temporal coherence and spatial coherence. 3
- ii) Write short notes on absorption, spontaneous emission and induced emission. 3
- iii) Derive the relation between Einstein's co-efficient for absorption, spontaneous emission and induced emission. 4

OR

- b) a) Mention the applications of LASER. 2½
- b) Write a short note on population inversion. 2½
- c) Explain the construction and working of Ruby Laser. 2½
- d) Calculate the coherent length for white light, the wavelength of which ranges from 400 n.m. to 700 n.m. 2½

5. Solve **any ten** questions from followings.

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| a) State the principles of superposition of waves. | 1 |
| b) Define S.H.M. | 1 |
| c) What are beats? | 1 |
| d) Define transverse waves. | 1 |
| e) What are standing waves? | 1 |
| f) What are mechanical waves? | 1 |
| g) What is noise? | 1 |
| h) Define Bel and decibel. | 1 |
| i) What is Acoustics? | 1 |
| j) Write long form of LASER. | 1 |
| k) Mention two characteristics of laser beam. | 1 |
| l) Define coherence. | 1 |
