BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSc **SEMESTER : III**
BRANCH: PHYSICS **SESSION : MO/2025**

SUBJECT: PH24207 WAVES AND OPTICS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Explain the phenomenon of superposition of collinear harmonic oscillations in the case of incoherent waves. Discuss the resulting amplitude characteristics.	[5]	1	2
Q.1(b)	What are Lissajous figures? Describe how the phase difference between two sinusoidal signals of identical frequency can be determined using Lissajous figures.	[5]	1	3
Q.2(a)	What are the normal modes of a stretched string fixed at both ends? A string of length $l = 40\ \text{cm}$ is under tension $T = 10\ \text{N}$. Find the frequency of the fundamental mode if the mass per unit length of the string is $3.6 \times 10^{-2}\ \text{g/cm}$.	[5]	2	3
Q.2(b)	Obtain the formula for speed of sound in air.	[5]	2	3
Q.3(a)	Discuss the working of Michelson interferometer by neatly constructing the setup of it.	[5]	3	2
Q.3(b)	Derive the expression of intensity pattern in Faby-Perot interferometer.	[5]	3	2
Q.4(a)	For light wavelength 500 nm and an obstacle of diameter 2 cm, how many Fresnel zone will be off if the screen is 2 m away? How many zones will the obstacle cut off if the screen distance become 4 m.	[5]	4	3
Q.4(b)	Show that a zone plate acts like a converging lens. For wavelength of 550 nm and $r_n = 0.1\sqrt{n}$ cm calculate first three focal lengths.	[5]	4	3
Q.5(a)	Prove that when two plane polarized waves of same amplitude superpose, the resultant wave is a plane polarized if the phase difference between them is $0°$ and a circularly polarized if the phase difference is $90°$.	[5]	5	3
Q.5(b)	Calculate the thickness of a quarter wave-plate for light of wavelength 589 nm. Refractive indices for o- and e-rays are 1.55 and 1.54 respectively.	[5]	5	3

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