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

CLASS: B.TECH / IMSC **SEMESTER : I/ADD**
BRANCH: BT/CIVIL/CHEMICAL/ME/PIE/FT/PHYSICS **SESSION :MO/2024**

SUBJECT: PH24101 / PH113 PHYSICS

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Define Malus's law. Explain all the terms.	[2]	1	1
Q.1(b)	An unpolarized incident light of intensity I_0 = 204 W/m^2 passes through a sequence of two polarizers placed along the x-axis. The axis of the first polarizer is 30 degrees from the z-axis and the second polarizer is at a relative angle of 45 degrees from the first one. Obtain the final intensity. What will be the final intensity if the first polarizer is removed?	[3]	1	2
Q.2(a)	Show that the geometric path difference between two rays reflected from a parallel thin film is $\Delta = 2d\cos\theta$ (Cosine law), where *d* is the thickness of the film and θ is the angle of refraction.	[3]	1	3
Q.2(b)	What is the minimum non-zero thickness of a (parallel) film so that light of wavelength 400 nm leads to constructive interference when incident normally.	[2]	1	2
Q.3(a)	What is Gauss's law? Determine the electric field outside a solid sphere of radius R and charge density ρ.	[3]	2	2
Q.3(b)	Determine whether $\vec{E} = 2x\,\hat{\imath} + 5y\,\hat{\jmath} + 6z\,\hat{k}$ is conservative.	[2]	2	2
Q.4(a)	What is the charge continuity equation? Explain all the terms.	[2]	2	2
Q.4(b)	What is displacement current? Briefly discuss its significance.	[3]	2	3
Q.5	Write down the Lorentz transformation equation (no derivation required) and show that, in the limit of v/c<<1, they lead to Galilean transformation equations. Explain all the terms. Write down a fundamental difference between Galilean and special theory of relativity.	[5]	3	2

::::::23/10/2024::::::E