BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2023)

CLASS: B.TECH/I.M.Sc. SEMESTER: I
BRANCH: BT/CIVIL/CHEMICAL/MECH/PIE/FT/PHYSICS SESSION: MO/2023

SUBJECT: 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)	Obtain the expression for Brewster angle for a polarizer made of material with refractive index n_2 immersed in a liquid of refractive index n_1.	[2]	1	1,3
Q.1(b)	Consider a sequence of three polarizers such that the first polarizer is aligned along the y-axis and the subsequent polarizers are at a relative angle of 45° from the previous one. Compute the intensities I_i $(i = 1,2,3)$ after each polarizer if the intensity of the y-polarized source is 1000 W/m^2.What happens if the second polarizer is removed?	[3]	1	3,4
Q.2(a)	Obtain the cosine law for interference between light reflected from parallel film of thickness t and refractive index μ.	[2]	2	3
Q.2(b)	A Newton's ring set up made of glass such that the radius of curvature of the curved surface is 100 cm is kept immersed in a liquid of refractive index μ. If the diameter of the 5th dark ring is 0.3 cm when incident with light of wavelength $\lambda = 5895$ Å, determine the refractive index of the liquid.	[3]	2	5
Q.3(a)	Calculate: (I) Gradient of $c \cdot r$, where c is a constant vector and r is the position vector. (II) Curl of $A = x^2 y\,\hat{k}$	[2]	2	4,9
Q.3(b)	Define Gauss's law. Using it, calculate the electric field **E** inside a solid sphere of uniform charge density ρ.	[3]	2	1,4
Q.4	Derive the boundary condition for the normal component of E (perpendicular to the interface) and for the tangential component of D (along the interface surface)	[5]	2	3
Q.5	State the postulates of special theory of relativity. Write the Lorentz transformation laws (no derivation required) and briefly discuss the differences with the Galilean relativity.	[5]	3	1,2,9

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