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

CLASS: B. TECH. **SEMESTER : II/ADD**
BRANCH: CSE, ECE, EEE, AIML **SESSION : SP/2025**

SUBJECT: PH24101 / PH113 PHYSICS

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)	Write down the conditions for constructive and destructive interference in a thin film geometry explaining all the terms. A thin soap film of refractive index $\mu = 1.33$ is illuminated by light at an angle of incidence $\theta_i = 53.13°$ (angle of refraction: $\cos(\theta_r) = 0.8$). In the reflected light, two dark consecutive overlapping fringes are observed corresponding to 610 nm and 600 nm. Calculate the thickness of the film.	[5]	1	3
Q.1(b)	Explain the single slit diffraction phenomena and draw the corresponding intensity pattern (use proper axis labels).	[5]	1	2
Q.2(a)	Write down Maxwell's equations in either integral or differential form.	[4]	2	2
Q.2(b)	Show that the normal (perpendicular) component of electrostatic displacement field $\vec{D}$ is discontinuous across an interface containing charges.	[6]	2	3
Q.3(a)	Show that the relativistic distance squared $ds^2 = c^2t^2 - x^2 - y^2 - z^2$ remains invariant under Lorentz transformations.	[5]	3	3
Q.3(b)	Write down the relativistic velocity addition formula and define all the terms. A stationary observer on Earth observes spaceships A and B moving in the same direction toward the Earth. Spaceship A has speed 0.8c and spaceship B has speed 0.50c. Determine the velocity of spaceship A as measured by an observer at rest in spaceship B.	[5]	3	3
Q.4(a)	What is de Broglie hypothesis? Determine the de Broglie wavelength of an electron of energy 1 eV.	[4]	4	2
Q.4(b)	Show that the energy values for a quantum particle in a one-dimensional box of width L varies as: $E_n = \frac{n^2\pi^2\hbar^2}{2mL^2}$.	[6]	4	3
Q.5(a)	Describe the phenomena of stimulated emission as applied to lasers using an appropriate schematic diagram. Mention any one characteristic of the emitted wave.	[4]	5	2
Q.5(b)	Explain the nuclear fission and nuclear fusion processes. Compare the energy released in these processes using the following examples: (a) When a uranium-235 nucleus absorbs a slow-moving neutron and undergoes a fission reaction, one possible pair of fission fragments is technetium-112 and indium-122. Data: Binding Energy (BE) per nucleon for $^{235}_{92}U$= 7.59 MeV, $^{112}_{43}Tc$ =8.36 MeV, and $^{122}_{49}In$ = 8.51 MeV. (b) Calculate the energy released in fusion reaction: $^{2}_{1}H + ^{2}_{1}H \rightarrow ^{3}_{2}He + n$, where BE of $^{2}_{1}H$ is 2.23 MeV and of $^{3}_{2}He$ is 7.73 MeV.	[6]	5	3

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