CLASS: BTECH   SEMESTER : II
BRANCH: CSE/AIML/ECE/EEE   SESSION : SP/2024

SUBJECT: 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)	What is polarization of light? Consider a geometry of sequence of two polarizers rotated at a relative angle of 45 degrees from each other. Determine the resulting intensity, amplitude, and polarization direction if the incident unpolarized (light) beam had the intensity I_0=100 W/m^2.	[4]	1	2
Q.1(b)	A parallel beam of light is incident on a thin film of refractive index 1.5 such that the angle of refraction is 60 degrees. Determine the smallest possible thickness of the film which will appear dark by reflection.	[3]	1	3
Q.1(c)	Draw the intensity patterns for single and double slit diffraction with suitable axis labels.	[3]	1	2
Q.2(a)	Calculate (i) gradient of $U = 2r^2$, (ii) curl of $\vec{a} = -y\,\hat{i} + x\hat{j}$, (iii) divergence of the position vector $\vec{r}$.	[3]	2	2
Q.2(b)	What is the charge continuity equation? Very briefly discuss its significance.	[2]	2	2
Q.2(c)	Write down Maxwell's equation in vacuum in either integral or differential form and briefly discuss the significance of any one of them.	[5]	2	2
Q.3(a)	Write down the basic postulates of special theory of relativity and derive the Lorentz transformation equations.	[5]	3	2
Q.3(b)	An elementary particle called a pi-meson (or pion for short) has an average proper lifetime of 2.6 x 10^{-8} s. (i) If it moves with a speed of 0.98c relative to Earth, find the average lifetime of the pion as measured by an observer on Earth. (ii) Find the ratio of the average distance travelled by the pion as measured by the same observer with and without relativistic considerations.	[3]	3	3
Q.3(c)	What is the relativistic energy mass equivalence (no derivation required). Find the energy equivalent of 1 amu. (Note, 1 amu = 1.66 x 10^{-27} kg.)	[2]	3	2
Q.4(a)	Obtain the de Broglie wavelength of a 100 eV electron.	[2]	4	2
Q.4(b)	Very briefly describe the Davisson Germer experiment and its findings.	[2]	4	2
Q.4(c)	Write down the time independent Schrödinger's equation for a quantum particle in a one-dimensional box and obtain its energies and wavefunctions. What is the ground state energy of an electron confined in box of 1 Å width.	[6]	4	4
Q.5(a)	Define nucleon binding energy. Draw the binding energy per nucleon curve and answer the following: (i) Which nuclei is the most stable? (ii) What is the possible nuclear process involving light elements.	[3]	5	2
Q.5(b)	Calculate the population ratio for the two states in a ruby laser at temperatures of 227°C considering the emitted wavelength to be 700 nm.	[2]	5	2
Q.5(c)	Briefly discuss the basic working principle of a ruby laser.	[5]	5	2

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