

Programme Name & Branch : B. Tech.
 Course Code and Course Name : BPHY101L, Engineering Physics
 Faculty Name(s) : Dr. Sasmita Mohakud, Dr. A. Ruban Kumar, Dr. S. P. Vijaya Chamundeeswari, Dr. Samir Ranjan Meher
 Class Number(s) : VL202425105967, 5975, 5983, 5991
 Date of Examination : 14-10-2024
 Exam Duration : 90 minutes Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO - Course Outcome; BL - Blooms Taxonomy Level (1 - Remember, 2 - Understand, 3 - Apply, 4 - Analyse, 5 - Evaluate, 6 - Create)
- Course Outcomes:
CO3: To apply quantum mechanical ideas to microscopic systems.

Q. No	Question	M	CO	BL
1.	A photon of energy E is scattered by a particle of rest mass energy E_0 . Find the maximum kinetic energy of the recoiling particle in terms of E and E_0 .	10	CO3	BL3
2.	a) Write down the expression for the average energy of a Planck oscillator to explain the blackbody isotherms. Show that the Planck's blackbody radiation formula is reduced to the classical expression at very low frequencies.	5	CO3	BL3
	b) A particle of mass m is confined to a one-dimensional line of length l . Estimate the smallest energy that the body can have by using uncertainty principle.	5		
3.	a) Find the energy (in keV) of an X-ray photon which can impart a maximum energy of 50 keV to an electron.	5	CO3	BL3
	b) Consider an electron confined within a length of 0.1 nm. Using Heisenberg's uncertainty principle, calculate the minimum uncertainty in the momentum of the electron. Also determine the corresponding minimum uncertainty in the kinetic energy of the electron.	5		
4.	a) A beam of electrons is incident on a potential barrier of strength 5.0 eV and width 0.3 nm. Find the energy that the electrons should have if 0.01% of them are to get through the barrier.	5	CO3	BL3
	b) Consider a marble of mass 10 g confined in a one-dimensional infinite potential well of width 1 m. Find the quantum number corresponding to an energy of 1 J.	5		
5.	Using the particle in a box model in quantum mechanics, prove that charge carriers confined inside a quantum dot can never be at rest.	10	CO3	BL3
