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CHENNAIReg. Number: **Continuous Assessment Test (CAT) – II- APRIL 2024**

Programme	:	B.Tech	Semester	:	Winter 2023-2024
Course Code & Course Title	:	BPHY101L Engineering Physics	Class Number	:	CH2023240500428 CH2023240500437 CH2023240500462 CH2023240500457
Faculty	:	Dr. Gopinath Mudhana Dr. Suprabh Prakash Dr. M.C. Ramkumar Dr. Shalini M G	Slot	:	B2+TB2
Duration	:	90 minutes	Max. Mark	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted

Section A - Answer all questions ($2 \times 15 = 30$)

Q. No	Sub Sec.	Questions	Marks
1.	a)	Using a non-relativistic approach, calculate the de Broglie wavelengths for an electron moving at 10% of the speed of light and for a tennis ball weighing 55g served at a velocity of 35 m/s.	6
	b)	Explain the significance of double peaks in Compton's experiment.	3
	c)	Draw the wave function Ψ versus position of electron in third excited state and also plot the maximum probability and minimum probability positions of the electron in that state of a 1D infinite potential box with width L.	6
2.	a)	Find the maximum percentage change in the wavelength when X-rays of frequency 5.0×10^{20} Hz is Compton scattered from a target. Can the Compton Effect occur when visible light is directed at a cesium target instead of X-rays; which effect would be more predominant in this scenario?	7
	b)	(i) Why laser light emission is not occurring naturally? Discuss in detail with necessary diagrams. (ii) A diode laser emits light of wavelength 528 nm and output power of 3mW, calculate the number of photons emitted per second.	5+3

Section B - Answer any two questions ($2 \times 10 = 20$)

3.	a)	An electron is confined in a one-dimensional box of length $L=50\text{nm}$ and it is measured to be somewhere between $x = 0.55 L$ and $x = 0.56 L$. Calculate the uncertainty in its velocity.	5
	b)	X-rays of wavelength 5.0 pm are scattered from an electron. (i) At what angle, relative to the direction of the incoming rays, the wavelength of scattered X-ray will be the largest? (ii) What will be the energy of the X-rays scattered in this direction? (iii) What is the maximum energy imparted to the target by such X-rays?	5
4.	a)	How do you prove the particle nature of radiation based on your understanding of this subject? Use only conceptual approach.	5
	b)	Consider an electron of energy 0.8 eV hits an infinite potential barrier of height 4 eV and width 0.25 nm . What is the probability of electron tunnelling through the barrier?	5
5.	a)	A copper ball of 8 mm diameter is broken in to very small diameter 8 nm pieces, Explain the possible change in any of their five properties the copper nanoparticles compared to its bulk form.	
	b)	An electron is confined in a one-dimensional infinite potential well of size 9 \AA . How much energy is required to excite the electron from the ground state to the fourth excited state?	

*****All the best *****