ANNAI VIOLET ARTS AND SCIENCE COLLEGE
DEPARTMENT OF PHYSICS

CONTINUOUS INTERNAL ASSESSMENT-I (ODD SEM)

Subject: Quantum Mechanics

Class: III B.Sc., Physics **Date: 02.09.2022-FN**
Max. Marks: 25 **Sub.Code:SR25C**

PART A (5 × 2 = 10 Marks)
Answer any FIVE questions

1. List out any two limitations of classical mechanics.
2. Briefly explain the Photo electric effect**.**
3. State Compton Effect.
4. Define matter waves.
5. Write a note on principle of superposition.
6. What are wave packets?
7. Write about the Expected value of wave function.

PART B – (2× 5 = 10 Marks)
Answer any TWO questions

8. Explain the Photo electric effect with diagram.
9. Derive one dimensional Time-dependent Schrodinger equation for a free particle.
10. Discuss Time independent Schrodinger equation.

PART C – (3 × 10 = 30 Marks)
Answer ALL questions

11. Describe Frank and Hertz experiment to show the quantum nature of atoms with neat diagram.
12. Explain electron diffraction experiment with necessary diagram.
13. Discuss in detail about Ehrenfest theorem.

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UNIT TEST-I

Subject : BASIC ELECTRONICS
SCHEME OF VALUATION

Class : III B.Sc., Physics **Date:22.08.2022-FN**
Max.Marks : 50 **Sub.Code:SR25D**

PART A (5 × 2 = 10 Marks)
Answer any FIVE questions

1. limitations of classical mechanics- **Any two limitations- 2 marks**
2. Electrons are ejected from the surface of a metal when light is incident on it – 1 mark
   Photoelectrons- 1 mark.
3. **Compton effect**, also called **Compton scattering**, increase in wavelength of X-rays and other energetic electromagnetic radiations that have been elastically scattered by electrons-**2 marks**.
4. A wave Associated with particle is called matter waves. - **1 mark**

   $\lambda = \frac{h}{p} = \frac{h}{mv}$ **- 1 mark**

5. Two or more waves meet at a point, the resultant displacement at that position is equal to the sum of displacements of the individual waves. – **1.5 mark**

   Illustration – **0.5 mark**

6. The wave function of a matter wave which confined to a small region of space is called wave packet – **1.5 mark**

   Diagram – **0.5 mark.**

7. $\langle x \rangle = \int_{-\infty}^{\infty} \psi^*(x,t)\, x\, \psi(x,t)\, dx$ - **1 mark**

   This integral can be interpreted as the average value of x that we would expect to obtain from a large number of measurements.- **1 mark**

PART B – (2 × 5 = 10 Marks)
Answer any TWO questions

8. Definition-1 marks

   Photons-1 mark

   Diagram- 1 mark

   Work function- 1 mark

   Relativistic expression- 1 mark

9. Equation of energy and wave number – **1 mark**

   Free particle wave function – **1 mark**

   Derivation- **2 marks**

   One dimensional Schrodinger equation- **1 mark**

10. $\psi(x,t) = u(x)T(t)$ **-2 mark**

$\frac{-\hbar^2}{2m}\frac{\partial^2 u(x)}{\partial x^2} + V(x)u(x) = E\,u(x)$ **-1 mark**

$\psi(x,t) = u(x)e^{-iEt/\hbar}$ **-1 mark**

PART C – (3 × 10 = 30 Marks)

Answer ALL questions

11. Theory- 2 marks

    Experimental arrangement- **4 marks.**

    Diagram –**4 marks**

    Limitations –**2marks**

12. Experimental arrangement- **4 marks.**

    Diagram –**4 marks**

    Limitations –**2marks**

13. $\langle p\rangle = m\frac{d\langle x\rangle}{dt} = m\frac{d}{dt}\int_{-\infty}^{\infty} x\,|\psi|^2\,dx = m\int_{-\infty}^{\infty} x\,\frac{\partial|\psi|^2}{\partial t}\,dx.$ **- 3 marks**

$\langle p\rangle = m\frac{d\langle x\rangle}{dt} = -\mathrm{i}\hbar\int_{-\infty}^{\infty}\psi^*\frac{\partial\psi}{\partial x}\,dx.$ **- 3 marks**

$\frac{d\langle p\rangle}{dt} = -\int_{-\infty}^{\infty}\frac{dV}{dx}\,|\psi|^2\,dx = -\left\langle\frac{dV}{dx}\right\rangle.$ **- 4 marks**