K20U 0140

Reg. No. : ....

Name : ....

**VI Semester B.Sc. Degree (CBCSS – Reg./Supple./Improv.) Examination,
April 2020
(2014 Admission Onwards)
Core Course in Physics
6B13PHY : QUANTUM MECHANICS**

Time : 3 Hours   Max. Marks : 40

SECTION – A

Answer **all**. Very short answer type. **Each** question carries **one** mark :

1. Expression for Compton wavelength is _____

2. Give the uncertainty relation for energy.

3. Expectation value of any observable is given by

4. The solution of Schrodinger equation of a free particle is _____

SECTION – B

Answer **any seven**. Short answer type. **Each** question carries **two** marks :

5. What is quantum mechanical tunneling ?

6. Explain Davisson and Germer experiment with proper diagram.

7. What is correspondence principle ?

8. Define the terms work function and cut off wavelength.

9. List the sets of possible quantum numbers for a hydrogen atom with n = 3.

10. An Eigen function of the operator d^2/dx^2 is $\Psi = e^{2x}$. Find the corresponding Eigen value.

11. State and explain uncertainty principle.

12. What is zero point energy of a harmonic oscillator ?

13. An electron and proton has same kinetic energy. Evaluate the ratio of de Broglie wavelength of electron to that of proton.

14. What is meant by Ultra Violet catastrophe ?

SECTION – C

Answer **any four**. Short essay/problem type. **Each** question carries **three** marks :

15. The threshold wavelength of silver is 2762 angstrom. Calculate the maximum kinetic energy of the ejected electrons and maximum velocity of electron when silver is illuminated with UV light of 2000 angstrom.

16. Show that the maximum recoil energy of a free electron of rest mass m_0, when struck by a photon of frequency ν is given by $E_{max} = \dfrac{(h\vartheta)^2}{h\vartheta + \dfrac{1}{2}m_0 c^2}$.

17. The time independent wave function of a particle of mass m moving in a potential $V(x) = \alpha^2 x^2$ is $\psi(x) = \exp\left(-\sqrt{\dfrac{m\alpha}{2\hbar^2}} x^2\right)$, where α being a constant. Find the energy of the system.

18. Solve the Schrodinger equation for one dimensional square potential barrier.

19. Find the energy of particle in a box using quantization rule.

20. Write down the expression for the wavelengths emitted by a hydrogen atom. Also explain the various spectral series of hydrogen atom.

SECTION – D

Answer **any two**. Long essay type. **Each** question carries **five** marks :

21. A) Explain the concept of elliptic orbits of hydrogen atom using Sommerfeld quantization rule.
    B) Explain the assumptions of Planck with regard to cavity radiation.

22. Derive the time dependent Schrodinger equation for a free particle.

23. Obtain the wave equation for linear harmonic oscillator.

24. Explain the different postulates of quantum mechanics in detail.