

Quantum Mechanics

Assignments

Write the answer of these questions:

1. (a) State the de-Broglie hypothesis of matter waves.

Derive an expression for de-Broglie wavelength of matter particle in terms of kinetic energy and temperature.

(b) Describe with necessary theory Davisson and Germer experiment for establishing wave nature of the electron. Discuss the effect of increasing the electron energy on the scattering angle in this experiment.

2. Discuss time-dependent and time-independent Schrodinger wave equations for a free particle.

3. (a) What do you understand by tunneling through a barrier? A particle travelling with energy  $E$  along  $x$ -axis, has a potential barrier defined as

$$V(x) = \begin{cases} 0 & \text{for } x < 0 \\ V_0 & \text{for } 0 < x < a \\ 0 & \text{for } x > a \end{cases}$$

Derive the expression for the reflection and transmission coefficients of the particle.

(b) Discuss briefly its applications to the observed phenomenon of  $\alpha$ -decay in nuclei.

Quantum Mechanics.

Expected Questions for End Semester Exam - 2020

Long answer type Questions

1. Concept of wave-particle dualism, de-Broglie hypothesis, Expression for de-Broglie wavelength in different forms. Davisson and Germer Experiment.
2. Time-dependent and Time-independent Schrodinger wave equations.
3. Rectangular potential barrier and its application to the observed phenomenon of  $\alpha$ -decay in nuclei.
4. Square well potential of finite depth.
5. Ehrenfest theorem.
6. one dimensional simple harmonic Oscillator.
7. Schwartz-inequality and its application use to derive Heisenberg's uncertainty relation.

Short answer type Questions

- ① de-Broglie hypothesis and expression for de-Broglie wavelength.
- ② Eigenvalues and eigenfunction.
- ③ Hermitian operator and its applications.
- ④ Expectation values of an operator.
- ⑤ Normalization and orthogonality of wave functions.