

BS- 2110
QUANTUM MECHANICS -I PAPER -III
SEM-III DEC-2019

10385/NH
M:MARKS :30

TIME : 3 HOURS

NOTE: The candidate are required to attempt two question each from Section A & B Section C will be compulsory . Attempt any five from Section C.

Section- A

- Q1. Define Group velocity. Derive an expression for it. Show that the group velocity of the wave packet is equal to the particle velocity. 5
- Q2. Define Uncertainty Principle. Derive expression for it. Explain the non-existence of electron in an atomic nucleus by applying uncertainty principle. 5
- Q3. Define the term Expectation value of any observable. Derive an expression for the expectation value of momentum. 5
- Q4. Obtain time independent form of Schrodinger wave equation for a particle subjected to force. 5

Section- B

- Q5. Write Schrodinger equation for a particle in a box and determine expressions for energy eigen values and eigen functions. 5
- Q6. Consider particle incident on a potential step of height V_0 with energy $E < V_0$. Calculate the reflection coefficient. 5
- Q7. Write down Schrodinger's equation for the electron of a hydrogen atom. Obtain three independent differential equations from it. 5
- Q8. State and explain four quantum numbers. Write quantum numbers for electrons in 1st sub-shell. 5

Section-C

9. Attempt any five parts.

- (a) What is the ground state energy of electron that is confined to a box of length 1.5 \AA .
- (b) Calculate the ratio of de-Broglie wavelength of proton and alpha particle having same velocity.
- (c) Define zero point energy of Harmonic Oscillator?
- (d) What is tunnel effect?
- (e) Define Eigen value and Eigen function.
- (f) What is difference between quantum mechanical angular momentum and angular momentum from Bohr's theory.
- (g) Show that operators p_x and p_y commute with each other. 2x5=10