



UNIVERSITY OF THE PUNJAB

Fifth Semester – 2019

Examination: B.S. 4 Years Program

Roll No. in Fig.

Roll No. in Words.

PAPER: Quantum Mechanics-I
Course Code: PHY-305 Part-I (Compulsory)

MAX. TIME: 15 Min.
MAX. MARKS: 10

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Signature of Supdt.:

Attempt this Paper on this Question Sheet only.

Please encircle the correct option. Division of marks is given in front of each question.

This Paper will be collected back after expiry of time limit mentioned above.

Q.1. Encircle the right answer, cutting and overwriting is not allowed. (1x10=10)

- 1- The commutator $[\hat{H}, \hat{P}_x] =$
 - a) $i \hbar$
 - b) \hbar^2
 - c) Zero
 - d) $i \hbar L_z$
- 2- The eigen values of Hermitian operator are
 - a) imaginary
 - b) real
 - c) matrix
 - d) none of these
- 3- Both basis and operators carry time dependence in
 - a) Dirac picture
 - b) Heisenberg picture
 - c) Schrodinger picture.
 - d) none of these
- 4- $\hat{a}|n\rangle =$
 - a) $\sqrt{n}|n-1\rangle$
 - b) $\sqrt{n+1}|n+1\rangle$
 - c) $\sqrt{n+1}|n-1\rangle$
 - d) $\sqrt{n}|n+1\rangle$
- 5- Which of the following is true about wave function
 - a) it is complex quantity
 - b) it may be negative
 - c) always real
 - d) both a and b

- 6- The sum of two projection operators is generally
- a projection operator
 - not a projection operator
 - null operator
 - unit operator
- 7- The mass of muon is
- 50 times mass of electron
 - 209 times mass of electron
 - half of mass of electron
 - none of these
- 8- Levi-civita symbol ϵ_{ijk} for even permutation of i, j, k is
- 1
 - 0
 - 1
 - none of above
- 9- The raising operator \hat{L}_+ of angular momentum is defined as
- $\hat{L}_x - i\hat{L}_y$
 - $\hat{L}_x + i\hat{L}_y$
 - $\hat{L}_x + i\hat{L}_z$
 - $\hat{L}_z + i\hat{L}_y$
- 10- The action of parity operator on e^x is
- e^x
 - e^{ix}
 - ie^x
 - e^{-x}



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PAPER: Quantum Mechanics-I

Course Code: PHY-305 Part – II

MAX. TIME: 2 Hrs. 45 Min.

MAX. MARKS: 50

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q2: Give short answers to the following questions: (4x5 = 20)

- i. Define a) expectation value b) eigen value of an operator
- ii. What is wave mechanics?
- iii. Explain degenerate spectrum.
- iv. What is importance of angular momentum in quantum mechanics?
- v. What is essence of correspondence principle?

Q3: (a) Show that eigen functions corresponding to different eigen values are orthogonal.

(b) Define Skew operator and hermitian operator. (7+3)

Q4: (a) Derive time independent Schrodinger's wave equation for a single particle.

(b) Write down three basic postulates of Quantum Mechanics. (7+3)

Q5: Find reflection coefficient and transmission coefficient of a beam of particles with energy greater than height of step potential. (10)
