UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program / Sixth Semester – 2019

Paper: Quantum Mechanics-II

Course Code: PHY-309 Part – I (Compulsory) **Time: 15 Min. Marks: 10**

Roll No. in Fig. ……

Roll No. in Words. ……

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Signature of Supdt.:

ATTEMPT THIS PAPER ON THIS QUESTION SHEET ONLY.

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 correct choice. (1x10=10)

(i) At classical turning points, the value of energy E is

(a) greater than potential (b) less than potential (c) equal to potential (d) None of these

(ii) The wavefunction associated with Helium-4 is

(a) anti sysmmetric (b) symmetric (c) zero (d) None of these

(iii) Pauli spin matrices are

(a) traceless (b) non-hermitian (c) singular (d) All of these

(iv) The spin of photon is

(a) 1 (b) 0 (c) 1/2 (d) 3/2

(v) WKB approximation is suitable for system with

(a) rapidly varying potential (b) slowly varying potential (c) classical turning points only (d) None of these

(vi) The sum of determinants for all Pauli spin matrices is equal to

(a) 0 (b) -1 (c) -3 (d) 2

(vii) Which of the following particle does not obey Pauli exclusion principle?

(a) Proton (b) alpha particle (c) neutron (d) All of these

(viii) The frame in which particles move with equal and opposite velocities before and after scattering is known as

(a) Inertial frame (b) Lab frame (c) center of mass frame (d) Non-inertial frame

(ix) In Heisenberg picture, the state vector is

(a) time dependent (b) frozen in time (c) zero (d) None of these

(x) Which of the following is not an approximate method for eatimating solutions of systems?

(i) WKB method (ii) Perturbation Theory (iii) Rayleigh-Ritz variational method

(iv) None of these

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B.S. 4 Years Program / Sixth Semester – 2019

Roll No. ……

Paper: Quantum Mechanics-II

Course Code: PHY-309 Part – I (Compulsory) **Time: 2 Hrs. 45 Min. Marks: 50**

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q.No.2 Answer the following short questions. (4x5=20)

(i) Compute $[S_z, S_x]$.

(iii) Define (a) PERMUTATION operator (b) HILBERT space.

(iii) Write down ANTI-SYMMETRIC WAVE FUNCTION for a system of three identical FERMIONS.

(iv) Write down validity of WKB method.

(v) What is difference between Schrodinger and Interaction pictures of Quantum mechanics?

Q.No.3 (a) Describe VARIATIONAL method as an approximate method. Write down the steps involved in this method. (5)

(b) Find the GROUND STATE ENERGY of a HARMONIC OSCILLATOR by using VARIATIONAL method. (5)

Q.No.4 Find the relation between scattering angles for two-particle scattering in LAB and CENTER of MASS frames. (10)

Q.No.5 Discuss briefly (5,5)

(i) PAULI Exclusion Principle (ii) BORN approximation