S. NO.: 21 BATCH: 2016 Reg. No.:

END OF SEMESTER EXAMINATIONS, APRIL / MAY - 2017
QUANTUM MECHANICS - II
SUBJECT CODE : 16P3PH05

MAJOR : M.Sc. (PHYSICS) **SEMESTER : II**
TIME : 3 HOURS **MAX. MARKS: 70**

SECTION A – (10 X 1 = 10)

Answer ALL the Questions:

1. The applicability of Born's approximation, the energy of incident particle should be very high and the scatterer should have _____.
   a) High atomic number b) low atomic number
   c) very high atomic number d) very low atomic number
2. The central field approximation is used to determine the central field in _____
   a) Thomas - Fermi statistical method b) Maxwell Boltzman distribution
   c) Bose Einstein distribution d) photon
3. The operators are do not commute one with another called _____
   a) Symmetric b) Anti symmetric c) Exchange d) Even parity.
4. In Relativistic Quantum mechanics, the spin ½ equation due to Dirac that describes an _____
   a) π meson b) baryon c) photon d) electron
5. The creation and annihilation of particles formulation are called _____
   a) Quantum field theory b) classical field theory
   c) Mechanics field theory d) classical dynamics
6. Define Differential scattering cross-section.
7. What are called as Electronic configuration of the atom?
8. Give the difference between Symmetric and Anti Symmetric wave functions.
9. Write down the expression for equation of continuity.
10. Define second Quantization.

SECTION B – (5 X 4 = 20)

Answer ALL the Questions:

11. a) Deduce an expression for the scattering cross section of particles by a spherically symmetric potential.

    [OR]

    b) Discuss the theory of scattering by a Gaussian potential.
12. a) Discuss about Hartee's self consistent field model.

    [OR]

    b) Explain in detail about Molecular orbital theory.
13. a) Discuss the Principle of Indistinguishability of identical particles.

    [OR]

    b) Prove that $[\sigma x, \sigma y] = 2i\sigma_z$.
14. a) Derive Schroedinger relativistic equation for a free particle.

    [OR]

    b) Mention the properties of α and β matrices.
15. a) Derive Hamiltonian classical field equation.

    [OR]

    b) Discuss about quantization of schroedinger equation for non-relativistic case.

SECTION C – (5 X 8 = 40)

Answer ALL the Questions:

16. a) Discuss the theory of Born approximation. Explain in detail.

    [OR]

    b) Deduce an expression for scattering by a screened coulomb potential.
17. a) Write a note on Thomas-Fermi statistical model.

    [OR]

    b) Explain in detail about Heitler London theory of hydrogen molecule.
18. a) Discuss in detail about Pauli spin operators.

    [OR]

    b) Discuss the theory of collision of identical particles.
19. a) Mention the application of Klein Gorden equation of Hydrogen atom. Explain in detail.

    [OR]

    b) Write a short note on i) Negative energy states.
    ii) Probability and current densities.
    iii) Spin orbit energy.
20. a) Discuss the theory of occupation number representation.

    [OR]

    b) Obtain the classical Lagrangian equation for a system of particles.