M.Sc. (Physics)   (Sem.–2)
QUANTUM MECHANICS-II
Subject Code : MSPH-423-21
M.Code : 91904
Date of Examination : 16-12-22

Time : 3 Hrs.   **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1.   **Write briefly :**

   a) Discuss the importance of Dirac equation.

   b) Signify the importance of negative energy solutions.

   c) What is non-relativistic limit of Dirac equation?

   d) What is the spin magnetic moment of electron?

   e) What is Lamb shift?

   f) Discuss the quantization of complex scalar field in QFT.

   g) What do you understand by Hamiltonian formalism of scalar field?

   h) What are Feynman rules?

   i) Write first order QED matrix elements.

   j) Define scattering cross section.

SECTION- B

2. What is the importance of Klein-Gordon equation?

3. What do you understand by spin-orbit interaction?

4. State and prove Noether theorem. Discuss its importance.

5. Explain in detail the covariant perturbation theory.

6. Evaluate the second order QED matrix elements.

SECTION- C

7. Formulate Dirac equation and discuss the plane wave solution.

8. a) Explain Lagrangian formalism of classical field.

   b) Discuss Feynman rules and diagrams and explain one example.

9. a) Obtain expression for scattering cross-sections and decay rates.

   b) Discuss in detail spin angular momentum of the dirac particle.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.