

M.Sc. (Physics) (CBCS Pattern) Semester-III  
**PSCPHYT09 - Paper-IX - Quantum Mechanics-II**

P. Pages : 2

Time : Three Hours



**GUG/S/25/11295**

Max. Marks : 80

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**Either:**

1. a) Explain first order perturbation theory of non-degenerate system and find the expression of energy and wave function. 8
- b) Explain normal and anomalous Zeeman effect. 8

**OR**

- e) Explain the first order Stark effect in ground and first excited state of H-atom. 8
- f) Explain the second order perturbation extension to degenerate. 8

**Either:**

2. a) Derive an expression of Fermi-golden rule of probability transition. 8
- b) Explain Einstein's atomic radiation and derive the Einstein's A and B coefficients. 8

**OR**

- e) Explain W.K.B. method and its application to barrier penetration. 8
- f) Explain variational principle and its application to ground state of He atom. 8

**Either:**

3. a) Explain ortho and para states of Helium atom and their perturbation by Coulomb repulsion. 8
- b) Explain Born-Oppenheimer approximation. 8

**OR**

- e) Discuss scattering theory and derive scattering cross section in laboratory and centre of mass system. 8
- f) Explain partial wave method and their importance. 8

**Either:**

4. a) Define Dirac-Hamiltonian for the relativistic particle what are the properties of  $\alpha$  and  $\beta$ ? 8

- b) Solve Klein-Gordon equation and discuss its limitations. **8**

**OR**

- e) Explain Spin-orbit interaction for Dirac's particles. **8**

- f) Explain negative energy state and their qualitative explanations. **8**

**5.** Answer all the following.

- a) Discuss Second order stark effect of H-atom. **4**

- b) Explain the dipole approximation. **4**

- c) Discuss the resonance scattering. **4**

- d) Write the equation for electron in electromagnetic field. **4**

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