

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

P. Pages : 2

Time : Three Hours



GUG/W/24/11295

Max. Marks : 80

Either:

1. a) Explain application of time independent perturbation theory. 8
- b) State and explain anomalous Zeeman effects with the help of heat energy diagram. 8

OR

- e) Explain first order perturbator theory of non-degenerate system and find the expression of energy and wave functions. 8
- f) Explain first order state effect in the ground state and first excited state of the H-atom. 8

Either:

2. a) What is variational principal? Explain its application to ground state of He-atom and Deuterium in Yukawa potential. 8
- b) What is Einstein's atomic radiation? What are Einstein's A and B coefficients Derive equation for them. 8

OR

- e) Explain the term barrier penetration. Also explain use of WKB method in barrier penetration. 8
- f) Discuss time dependent perturbation theory and derive the expression of fermi-Golden rule of probability transition. 8

Either:

3. a) Explain scattering cross-section in laboratory and centre of mass system and scattering by a control potential. 8
- b) Explain in detail Heitler-London theory of the hydrogen molecules and its applications. 8

OR

- e) Describe the method of scattering by an attractive square well potential and perfectly right sphere. 8
- f) Derive an expression of wave function and energy of the ortho and para states of the helium atoms and their perturbation by coulomb repulsion. 8

Either:

4. a) Discuss the solution for Hydrogen atom in Dirac's theory. 8
- b) Derive Klein-Gordon relativistic equation for a free particle. 8

OR

- e) Explain spin-orbit interaction for Dirac's particles. 8
- f) Write down the Dirac equation for a free particle and construct matrices for $\alpha_x, \alpha_y, \alpha_z$ and β . 8

5. Attempt all of the followings.

- a) Write a note on second order stark effect in harmonic oscillator. 4
- b) Give interpretation of Yukawa potential in deuteron. 4
- c) What do you mean by identical particles? Explain. 4
- d) What is negative energy states. Give its physical significance. 4
