K16P 1159

Reg. No. : .....

Name : .....

Third Semester M.A./M.Sc./M.Com. Degree (Reg./Suppl./Imp.) Examination, November 2016
PHYSICS
(2013 and Earlier Admissions)
PH – 301 : Quantum Mechanics – II

Time : 3 Hours Max. Marks : 50

SECTION – A

Answer **any two** questions. **Each** question carries **10** marks.

1. Using the Hamiltonian of the atom in the presence of electromagnetic radiation derive an expression for the transition dipole moment and the transition probability.
2. Obtain the expression for energy of a charged particle obeying Klein-Gordon equation in a coulomb potential. Explain the significance of the different terms.
3. Explain Hartree's self consistent field method and discuss the results of the theory for multi electron atoms.
4. Discuss the necessity of quantum states described using density matrices.

(2×10=20)

SECTION – B

Answer **any five** questions. **Each** question carries **3** marks.

1. Explain anomalon Zeeman effect.
2. What is Born-Oppenheimer approximation ?
3. Distinguish between stimulated emission and spontaneous emission.
4. Define scattering length. How is it related to zero energy cross section ?

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5. Give the Wey l's equation for the neutrino. What is its significance ?
6. What is EPR Paradox ?
7. State Bell's theorem. What is its importance ?
8. What are Fermion creation and annihilation operators ? Express mathematically.

(5×3=15)

SECTION – C

Answer **any three** questions. **Each** question carries **5** marks.

1. What is spin orbit interaction ? Define spin orbit coupling constant. Why is spin orbit interaction zero for S-electron ?
2. What are Einstein's A and B coefficients ? Obtain the relation between the two.
3. What is Born approximation ? Discuss the validity conditions for Born approximation.
4. If $\overline{\alpha}$ and $\overline{\beta}$ are dirac matrices, prove that

   a) $\alpha_x = \frac{1}{2}\left[\alpha_x\alpha_y, \alpha_y\right]$

   b) $\alpha_x\alpha_y\alpha_z = \frac{1}{2}\left[\alpha_x\alpha_y\alpha_z\,\beta, \beta\right]$.

5. Discuss the relativistic Hamiltonian and Lagrangian. **(3×5=15)**
