(b) Explain variational method and evaluate the energy levels of normal state of He(Helium) atom using variational method.

6. (a) Applying Born approximation, derive the differential scattering cross section for scattering by a screened coulomb potential.

OR

(b) Discuss the method of partial wave analysis and derive the total scattering cross section at low energy by a hard sphere.

2016

Time : 3 hours

Full Marks : 80

The figures in the right-hand margin indicate marks.

Answer from both the Sections as directed.

(QUANTUM MECHANICS – II)

Section – A

1. Answer any **four** questions of the following : 4×4 = 16

(a) Find the expression for plane waves in terms of spherical waves.

(b) Briefly explain the normal zeeman effect.

(c) Explain Fermi's Golden rule.

(d) Explain the concept of scattering cross section.

(e) Explain Bohr-Sommerfeld quantization rule.

(f) State and prove optimal theorem.

OR

2. Answer **all** questions from the following : 2×8 = 16

(a) Differentiate between degeneracy and non-degeneracy.

(b) Write the expression for radial equations for hydrogen atom.

(c) Write the different aproximation techniques in perturbation theory.

(d) Define anarmonic oscillator energy wave functions.

(e) Write the eigen value and eigen functions of Harmonic oscillator.

(f) State variational principle.

(g) What is Scattering amplitude ?

(h) What is Coulomb interaction ?

Section – B

Answer **all** questions : 16×4 = 64

3. (a) Obtain the eigen values and eigen functions of Hydrogen atom.

OR

(b) Explain the radial probability distribution and derive the eigen values and eigen functions of free-particle.

4. (a) Discuss the time independent perturbation theory for non-degenerate systems and solve the problem of hydrogen atom using this theory.

OR

(b) Give the theory for the time-independent perturbation theory for degenerate systems and explain linear stress effect in hydrogen atom.

5. (a) Discuss the time dependent perturbation theory and apply to an atom exposed to harmonic perturbation.

OR