SECTION B — (5 × 4 = 20 marks)

11. (a) Show that the scattering amplitude $f(\theta, \phi)$ bears a relation with scattering cross section $\left(\frac{d\sigma}{d\Omega}\right)$.

Or

(b) In the neutron proton scattering, assuming that the range of the attractive force 'a' to be approximately, 3×10^{-13} cm, show that the scattering amplitude will be almost isotropic (in the centre of the mass system) for neutron energy < 10 MeV.

12. (a) What is the Poisson's equation used in Thomas–Fermi statistical model to determine the potential? What are the boundary conditions for V(r)?

Or

(b) Write a note on doublet separation.

13. (a) What are the trial wave functions assumed in H_2^+ ion problems?

Or

(b) Give examples for covalent bonding.

14. (a) How does Planck's concept of 'black body' is connected with 'emission' or 'absorption' of radiations by 'atoms' constituting the walls?

Or

(b) Give any two applications of density matrix.

15. (a) If the Lagrangian 'L' for a system where the single particle Hamiltonian is Hermitian is given by, $L = \frac{i\hbar}{2} \sum_i \left(\overline{a}_i \dot{a}_i - \dot{\overline{a}}_i \overline{a}_i\right) - \sum_i H_{ij} \overline{a}_i a_j$, then what are the natures of L?

Or

(b) If a_i and $\overline{a}_i$ are generalised co–ordinates, what are the respective conjugate momenta's values?

SECTION C — (5 × 8 = 40 marks)

16. (a) Derive expression for the scattering amplitude for the scattering by Yukawa's potential.

Or

(b) Obtain suitable expression for the solution for ψ for the scattering in terms of Green's functions.