Jashore University of Science and Technology

Department of Physics

Master of Science in Physics

Course no.: PHY 5111

Course title: Condensed Matter Physics

Assignment no.: 03 **Date: December 03, 2024**

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1. Explain the approximations that are made in Hartree-Fock method for the determination of the wave function and the energy of a quantum many-body system.

2. What are meant by: (i) Coulomb integrals, (ii) exchange integrals, (iii) correlation energy, (iv) restricted Hartree-Fock method.

3. Drive the functional form for the total energy as described in the Thomas-Fermi model. Write down the advantages and limitations of the Thomas-Fermi model.

4. Write a short note on Hohenberg-Kohn theorem. What are the advantages and limitations of the theorem?

5. Write a short note of Kohn-Sham density functional theory (DFT). Why the choice of right exchange-correlation functional is crucial in solving the Kohn-Sham equation?

6. Define plasmons, polaritons, polarons and phonons. Write down their characteristics.

7. What is plasma frequency? Find an expression to calculate the plasma frequency of electrons in the plasma.