

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.: 02 **Date: September 12, 2023**

Last date of submission: September 23, 2023

- 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.