B.Sc. (Hons) Physics,
Class: VI Sem, Sec.-A
Paper: Statistical Mechanics
Teacher: Dr. Arpita Vajpayee

As we have started "Fermi-Dirac Statistics" unit. Following topics will be discussed in this week:

1) Thermodynamics functions of a strongly degenerate Fermi gas
2) Fermi Energy and Fermi velocity
3) Electron gas in Metals
4) Specific heat of Metals

Please read the above mentioned topics.

I am available for discussion on the class WhatsApp group at the time of our scheduled class according to the timetable. You can post your doubts/queries on this group. Several E-books have already been shared on the class WhatsApp group.

Numerical problems:

Q-1) The Fermi energy in silver is 5.51 eV. (a) What is the average energy of the free electrons in silver at 0K? (b) At what temperature a classical free particle (such as ideal gas molecule) will have this kinetic energy.

Q-2) Calculate the Fermi energy, pressure in aluminium at absolute zero. Also calculate the Fermi momentum, Fermi velocity, Fermi temperature, average energy per atom at absolute zero and electronic contribution to heat capacity of aluminium at 100K. The density of aluminium is 2.7×10^3 Kg/m^3, atomic weight of Al is 26.98 Kg/(Kmol), Na = 6.02×10^{26} atoms/(Kmol), h = 6.63×10^{-34} Js, $m_e = 9.11 \times 10^{-31}$ Kg.

Q-3) Calculate the Fermi energy and the electronic contribution to constant volume heat capacity of copper at 300 K. Take N/V = 8.5×10^{28} per m^3, h=6.62×10^{-34} Js, m_e=9.11×10^{-31} Kg, k_B=1.38×10^{-23} J/K and R = 8.314 J/K.

Please send your solutions by e-mail.

Assignment problem:

A-1) Show that mean energy of free electron at absolute zero is 3/5 times of Fermi energy at absolute zero.

A-2) Given a Fermi gas, what is the mean occupation number for a state with energy $2k_Bt$ above the Fermi Energy?