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

As we have done "Classical Theory of Radiation", now we shall discuss next unit i.e. "Quantum Theory of Radiation". Following topics will be discussed:

1) Planck's Quantum Postulates
2) Planck's law of Blackbody Radiation: Experimental Verification
3) Deduction of: (a)Wein's distribution law, (b)Rayleigh-Jeans law, (c)Stefan-Boltzmann law and (d)Wein's displacement law from the Planck's law

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. E-books have already been shared on the class WhatsApp group.

Few numerical problems:

Q-1) Calculate the average energy of an oscillator of frequency 0.60×10^{14} Hz at T=1800 K, treating it as (i) Classical oscillator and (ii) Planck's oscillator.

Q-2) Calculate the number of modes in a chamber of volume 50 cc in the frequency range $4x10^{14}$ Hz to $4.01x10^{14}$ Hz.

Q-3) Calculate the maximum amount of heat which may be lost per second by radiation from a sphere of 5 cm in diameter at a temperature of 600K when placed in an enclosure at a temperature of 300K. [Stefan's constant = $5.7x10^{-12}$ watt/cm^2-(^{o}C)$^{-4}$]

Q-4) At what rate does radiation escape from a hole 10 cm^2 in area, in the wall of a furnace whose interior is at a temperature of 1000K?

Please post your solutions on class WhatsApp group.

Assignment problem:

A-1) The surface temperature of the Sun is about 5500K and its radius about $7x10^8$ m. The radius of Earth is about $6.4x10^4$ m and the mean distance of the Earth from the Sun is about $1.5x10^{11}$ m. Assume that the Sun acts as a perfect black body and that the Earth absorbs the entire radiation incident on it. Given that the Earth is in radiative equilibrium, estimate the temperature of the Earth.