Department of Physics, IIT Kanpur, Semester II, 2016-17

PSO201A: Quantum Physics **Quiz # 1** **Time: 35 Minutes** **Max Marks: 100**

Name: ..... **Roll No.:** ..... **Section**.....

Problem 1: Consider a cavity with metallic walls in thermal equilibrium as a blackbody. Find the relationship between the radiance of the blackbody and the energy density in the cavity. **(25 marks)**

Problem 2: Using Planck's hypothesis and Boltzmann's probability distribution, calculate the average energy of a standing wave at frequency ν inside a cavity at temperature T. [useful formula: $\sum_{n=0}^{\infty} x^n = 1/(1-x)$] **(25 marks)**

Problem 3: For a photon of wavelength λ_0, scattering off of an electron of rest mass m_0, find the relationship between the photon scattering angle θ and the electron scattering angle ϕ. **(25 marks)**

Problem 4: For an electron microscope to have a resolution of 0.1 Å, what is the minimum kinetic energy that the electron needs to have? ($m_0c^2 = 0.511$ MeV for an electron.) **(25 marks)**