

## EP 1108 Assignment 2

Deadline **1 Feb 2022** before **17:00 hrs**

1. Calculate the surface temperature of the Sun (in Kelvin) by assuming that it is a spherical black body with a radius of  $7 \times 10^8$  m. The intensity of solar radiation at the surface of the Earth is  $1.4 \times 10^3 \text{ W/m}^2$  and the distance between the Earth and the Sun is  $1.5 \times 10^{11}$  m. [3 pts]
2. Obtain the Rayleigh-Jeans spectral distribution law as the long-wavelength limit of the Planck spectral distribution law. [2 pts]
3. Using the Planck spectral distribution law for  $\rho(\lambda, T)$  prove Wien's displacement law. [3 pts] [Hint : Set  $x = hc/\lambda kT$  and show that  $x$  must satisfy the equation  $x = 5(1 - e^{-x})$  for which the solution  $x = 4.965$  can be assumed]
4. The Barnard star has a temperature of 3000 K. Calculate its total emissive power and the wavelength at which its spectral emittance  $R(\lambda, T)$  peaks. [4 pts]