

Homework:1

Due date: 28th January 2025

1. Get the approximate Sun's temperature and plot the Plank's radiation. Compare this with the solar spectrum that is received on the ground. There are some standards like say AM 1.5. Why are certain range of wavelengths absent on the ground spectrum ?[5]
2. Plot the black body radiation spectrum for temperatures $T = 273\text{K}, 500\text{K}, 2000\text{K}, 5000\text{K}$. which one will you use for IR spectrometer and why ? [2]
3. Look up Airy functions. Plot it with a software. These functions are solutions to a known differential equation. Can you describe that equation ? [2]
4. What is a diffraction grating ? How is wavelength separation achieved using such a structure and what is the physical requirement for the spectrometer using diffraction gratings [2]
5. In the traditional FTIR interferometer, Assuming the light to be a plane wave of form $\psi = Ae^{ikx}$, find the sum of light from two paths: one path has a tunable delay of δ . Remember to assume mirrors do not introduce change in phase (in reality, they add 180 phase shift, but since the phase shift is common to both the paths, it does not affect our calculations.) [5]
6. How are the following similar and different?[4]
 - a. σ molecular orbital and π molecular orbitals
 - b. Bonding and non bonding orbitals
7. Describe the procedure you would follow to calculate cuvette volume for a known sample. Assume the sample has an absorptivity of ϵ and you prepare the sample with concentration c . The detector can utmost detect 1% change in the intensity.[3]