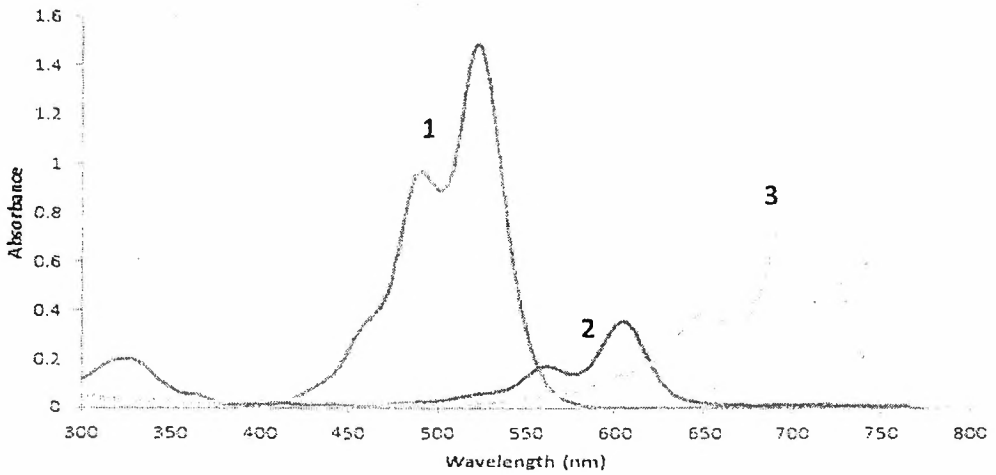
Mid Sem Examination-February 2019

CH2201 (Fundamentals of Spectroscopy)

Time: 1 hr | Answer 'Any five' Questions | Max. Marks: 20

1. Absorption spectra of three different dyes (Dye 1-3) of the same concentration are given below (recorded in the same experimental condition). Out of this three, which dye you would choose to make a red coloured solution. Comment the reason for the difference in intensities at λ_{max} of the three spectra. (4 Marks)



2. A space probe was designed to see CO in the atmosphere of Saturn by looking for lines in its rotational spectrum. If the bond length of CO is 112.8 pm, at what wave number do the first three rotational transitions appear? (4 Marks)

3. For a certain rotationally active molecule, the υ(MHz) *vs* J plot shows a slope of 8712 MHz. Calculate (a) the rotational constant for the molecule and (b) also the wave number of the most intense signal at 273 K and 1000 K? (4 Marks)

4. A gaseous molecule undergoes ~10^9 collisions per second. Suppose that (a) every collision is effective in deactivating the molecule rotationally and (b) one collision in 10 is effective. Obtain the width (in Hz) of rotational transitions in the molecule. (4 Marks)

5. In a certain spectroscopic experiment, other possibilities of spectral broadening are excluded except the natural broadening. Estimate the lifetime of a state that gives a spectrum with a line of width (a) 0.012 meV, (b) .186 meV. (4 Marks)

6. The force constant of GaBr is 240 Nm^{-1}. Calculate the fundamental vibration frequency and the zeropoint energy of GaBr. (Atomic mass Ga: 69.723 amu and Br: 79.904 amu) (4 Marks)

Speed of light (c): 3×10^8 ms^{-1}	Boltzmann constant (k_b) : 1.38×10^{-23} JK^{-1}
Planck's constant (h): 6.626×10^{-34} Js	Atomic mass unit (a.m.u) : 1.66×10^{-27} kg
1 eV= 1.602×10^{-19} J	1 eV = 1240 nm

7/9/2019