

## Home Assignment (6<sup>th</sup> Semester)

Total Marks – 15

1. Write the quantum mechanical theory of Raman spectroscopy. Show schematically the Rayleigh, Stokes and antiStokes lines. 3
2. The bond length of  $^{35}\text{Cl}_2$  molecule is 198.2 pm. Calculate the distance of the first Stokes line from the exciting line. Also, calculate the separation between the successive Stokes lines. Isotopic mass of  $^{35}\text{Cl}$  is 34.97 u.  
[Hint. *The separation of the first Stokes line from the exciting line is 6B, while the separation between the successive lines is 4B*] 3
3. The spacing between the successive S-branch lines in the pure rotational Raman spectrum obtained from  $\text{H}_2$  is  $24.368 \times 10^3 \text{ m}^{-1}$ . Calculate that bond length of  $\text{H}_2$ . Given that mass of a H atom is  $1.67 \times 10^{-27} \text{ kg}$ . 3
4. Which of the following will be Raman active, but not IR or microwave active? 1  
HCl,  $\text{CO}_2$ ,  $\text{O}_2$ ,  $\text{H}_2\text{O}$
5. Explain why Stokes lines are more intense than antiStokes lines? 3
6. Ethyne shows two IR bands and three Raman bands but none of these bands occur at the same wave number. Explain what information you can draw from this observation regarding the structure of the molecule. 2  
[Hint. *Rule of mutual exclusion*].