Indian Association for the Cultivation of Science
(Deemed to be University under *de novo* Category)
Integrated Bachelor's-Master's Program
End-Semester Examination-Spring 2024

Subject: Spectroscopy of Atoms and Molecules　　　　*Subject Code(s): CHS 1201 Lab*
Full Marks: 25　　　　*Time Allotted: 3 h*

Part – I

1. (a) 250 mL of 2 (M) stock solution of sucrose is provided to you. How will you prepare 10 mL 0.75 (M) sucrose solution? [1.5]

    (b) You are provided with 0.6 (M) 25 mL aqueous solution of acetic acid and 0.4 (M) 50 mL aqueous solution of NaOH. How will you prepare 0.2 (M) 10 mL sodium acetate solution from these? [2]

2. How does presence of impurity affect the melting point of a crystalline substance. [1.5]

3. What is optical activity? You have been provided with the plot of optical rotation vs. concentration of sucrose solution obtained from polarimetry experiment. The slope of the plot was found to be 15.10 deg.M^{-1}. Given, that the path length of cell is 10 cm and optical rotation of an unknown solution was 6 degrees, find the concentration of the unknown sample as well as specific rotation of sucrose. [1+1.5]

4. What is Lambert Beer's Law? A solution of substance 'A' having a concentration of 0.15 mol L^{-1} has an absorbance of 0.42. Another solution of 'A' under the same conditions has an absorbance of 0.36. What is the concentration of this second solution of 'A'? [1.5+1.5]

5. Suppose you have performed spectroscopic experiment on bromocresol green to find its acid dissociation constant (K_a). It is known that it follows the equilibrium: $HB^- \rightleftharpoons H^+ + B^{2-}$. For pH 4.23, $[B^{2-}]/[HB^-]$ was found to be 0.35. Find K_a of bromocresol green using this information. [2]

Part – II

6. Analysis of gas phase rovibrational spectrum of CO　　　　[12.5]

    a) Mark the first 10 rovibrational bands of P branch and R branch separately.
    b) Write the expression of rovibrational energy and using it derive an expression and hence find the rotational constant of CO.
    c) Find the moment of inertia of CO.