PRN: Course Code : P61PE201

First Year **M. Sc.** End Semester Examination Summer 2024

Molecular Spectroscopy and Electrochemistry

Day and Date: 27 MAY 2024 , Mon Max Marks: **50**

Time : 02:00PM To 04:00PM Duration: **03** hrs

Instructions:

i) All questions are compulsory.

ii) Use of log table and scientific calculator is allowed

iii) Draw neat and labeled diagrams where ever necessary.

		Marks	Blooms Level	CO
Q.1	**Attempt the following**			
a)	What is the meaning of the equivalent conductivity of an electrolyte at infinite dilution? Show it graphically.	2	L1	CO1
b)	What is micellization? Write the Arrhenius equation indicating the effect of temperature on the energy of micellization.	2	L2	CO2
c)	Define the property surface tension of liquids. Indicate the effect of the addition of solute on the surface tension of water.	2	L2	CO2
d)	Calculate energy absorbed by the molecules in the following vibrational transition, $v = 2 \rightarrow v = 3$.	2	L3	CO3
e)	The reduced mass of carbon monoxide (CO) molecule is 11.38×10^{-24} gm. Calculate the moment of inertia it the bond length is 1.131 A^{O}	2	L3	CO4
Q.2	**Solve any two of the following**			
a)	Write the Debye-Huckel-Onsagar equation and the significance of the terms in this equation. Discuss the method of determination of equivalent conductivity of strong electrolytes using this equation.	5	L3	CO1
b)	Derive an equation for the activity and mean activity coefficient of an electrolyte. Calculate the activity of ZnCl2 solution which is 0.1 molal. The mean molal ionic activity coefficient is 0.9.	5	L3	CO1
c)	Discuss Arrhenius theory of electrolytic dissociation of an acid. Show that the degree of dissociation is directly related to the square root of the concentration of an acid.	5	L2	CO1

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Q.3	**Solve any two of the following**				
	a)	Discuss the capillary rise method of determining the surface tension of liquids.	5	L2	CO2
	b)	What are the surfactants? Discuss the classification and applications of surfactants.	5	L2	CO2
	c)	Explain the surface tension method of determination of critical micelle concentration of surfactant.	5	L3	CO2
Q.4	**Solve any two of the following**				
	a)	What is surface excess concentration? Write the equation for Gibb's adsorption isotherm with usual notations. Discuss how this isotherm is used to determine the surface area of isopropyl molecule.	5	L3	CO2
	b)	Give the assumptions of Freundlich adsorption isotherm. Explain how the equation of this isotherm is used to obtain graphically the constants 'a' and 'K'.	5	L2	CO2
	c)	Discuss with a neat diagram the different vibration modes of water molecules.	5		CO3
Q.5	**Solve any two of the following**				
	a)	Explain the origin of the vibrational spectrum of the diatomic molecule by constructing the energy level diagram. Show that the vibration frequency of oscillations of the diatomic molecule is ϖ cm^{-1}.	5	L4	CO3
	b)	What is the isotopic substitution? Discuss with a neat energy level diagram the isotopic substitution effect on the rotational spectrum of diatomic molecules.	5	L3	CO2
	c)	What is the reduced mass of the diatomic molecule? Show that the moment of inertia is the product of reduced mass and square of the bond length of the molecule.	5	L2	CO2

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