ACTIVITY CODE: 1903027021

B.Sc. 6th Semester (Honours) Examination, October 2020

Subject: Chemistry

Course ID: 61412 **Course Code: UG/CHEM/602/C-14**

Course Title: Physical Chemistry-IV(C-14)(T)

Full Marks: 12 **Time: 45 Minutes**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as possible.

1. Answer *any three* of the following questions: 1×3 = 3

   a) Which mode of CO_2 is infrared inactive but Raman active?

   b) Find the dimension of surface tension.

   c) Among the species Cu^+, Cu^{2+}, H_2 which one will show ESR spectrum?

   d) What will be the angular velocity of CO molecule in its ground state?

   e) Define zeta potential.

   f) Define quantum yield of a photochemical reaction.

   g) Find the degree of degeneracy of the rotational energy state for quantum number J = 4.

   h) Why is phosphorescence a relatively slower process?

   i) Adsorption is always an exothermic process. Justify.

2. Answer *any one* of the following questions: 5×1 = 5

a) i) The surface tension of Hg at 20 ^{o}C is 0.485 Nm^{-1}. If the two globules of Hg, each of radius 1 cm stick together to form one globule, then calculate the change in the surface free energy. 3

ii) Assuming Langmuir adsorption isotherm plot $1/\theta$ vs. $1/P$ (terms have their usual significance). Find the value of the slope of the above plot. 2

b) i) Starting from the energy expression for rigid rotator arrive at the conclusion that rotational lines are equispaced. 3

ii) Why is high external magnetic field used in NMR spectroscopy? 2

c) i) Define photochemical equilibrium. 2

ii) Calculate the molar absorption coefficient for a 2.75 x 10^{-4} M solution placed in a cell of path length 1.00 cm which transmits 22.7% of the incident light. 3

3. Answer *any one* of the following questions: 4×1 = 4

a) i) 'A surface film is an analogue of a 2-dimensional ideal gas' – Justify. 2

ii) Cite two fundamental differences between thermochemical and photochemical reactions. 2

b) i) Define Stokes and anti-Stokes lines in Raman spectra. 2

ii) What are the essential differences between the ^{1}H-NMR spectra of methanol and ethanol? Explain. 2

c) i) How surface tension depends on temperature? 2

ii) Which rotational energy state is mostly populated at a temperature 27 ^{o}C having rotational constant B equal to 10 cm^{-1} for a diatomic rigid rotator? 2

xxxxxxxxxxxxxxxxxxxxx