R—37—2017

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

MARCH/APRIL, 2017

CHEMISTRY

Paper XIII

(Physical and Inorganic Chemistry)

(Saturday, 25-3-2017)   **Time : 10.00 a.m. to 12.00 noon**

Time—Two Hours   *Maximum Marks—40*

N.B. :—   (*i*)   Use same answer book for Section A and Section B.

       (*ii*)   Use of logarithmic table and non-functional calculator is allowed.

       (*iii*)   Attempt *All* questions.

Section A

(Physical Chemistry)

1.   Answer any *five* of the following :   5×2=10

    (*a*)   What are the characteristics of third order reaction ?

    (*b*)   Explain the chain reaction with respect to different steps involved in it.

    (*c*)   What are complex reactions ? Which are different types of complex reactions ?

    (*d*)   Discuss gaseous HCl molecule is microwave active and H_2 molecule is microwave inactive.

    (*e*)   Explain the transition $\pi \rightarrow \pi^*$ with energy level diagram.

    (*f*)   Write a note on liquid-liquid chromatography.

    (*g*)   Derive an expression for Nernst distribution law.

P.T.O.

2. Answer any *two* of the following : 2×5=10

(a) The pure rotational spectrum of the gaseous diatomic molecule consists of a series of equally spaced lines separated by 3.33 cm^{-1}. Calculate the internuclear distance of the molecule. The reduced mass of molecule is 1.11×10^{-26} kg [$h = 6.626 \times 10^{-34}$ Js, $c = 3 \times 10^8$ m/s, $\pi = 3.142$, 1 cm^{-1} = 10^2 m^{-1}].

(b) Discuss the kinetics of consecutive reaction.

(c) Explain the pure rotational Raman spectra of linear diatomic molecule.

3. Answer any *one* of the following : 1×7=7

(a) Show that the microwave spectrum of a rigid diatomic molecule consists of series of lines with separation of 2B cm^{-1}.

(b) (i) Derive an expression for equilibrium constant from distribution coefficient.

(ii) The experimental study of the distribution of solute between water and organic solvent gave the following result :

Concentration of solute in water (C_1) : 0.158   0.0235

Concentration of solute in organic solvent (C_2) : 0.336   0.751

Determine the molecular state of solute in the organic solvent.

Section B

## (Inorganic Chemistry)

4. Solve any *three* of the following : 3×3=9

(a) Give the classification of organometallic compounds.

(b) What is the action of halogen, carbon monoxide and alkyl halide on organolithium compounds ?

(c) Write the application of organotin compounds.

(d) What are metal carbonyls ? Explain mononuclear and polynuclear carbonyls with suitable example.

(e) Give the properties of $Ni(CO)_4$.

5.   Solve any *two* of the following :   2×2=4

   (*a*)   Draw the structure of :

   (*i*) $Fe_2(CO)_9$

   (*ii*) $Fe_3(CO)_{12}$.
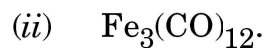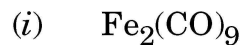
   (*b*)   How are organotin compounds prepared by using Wurtz reaction and Grignard reactions.

   (*c*)   Give the application organotitanium compounds.

   (*d*)   Give any *two* methods of preparation of organoaluminium compounds.