

This question paper contains 3 printed pages]

PA—10—2024

FACULTY OF SCIENCE

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

MARCH/APRIL, 2024

(New/CBCS Pattern)

CHEMISTRY

Paper : XIII (B₁)

(Physical and Inorganic Chemistry)

(Monday, 08-04-2024)

Time : 10.00 a.m. to 12.00 noon

Time—2 Hours

Maximum Marks—40

N.B. :— (i) Attempt *all* questions.

(ii) Figures to the right indicate full marks.

(iii) Use logarithmic table and non-functional calculator is allowed.

1. Answer any *three* of the following : 3×5=15

(a) Write down any *two* methods for preparation of ferrocene and explain the aromaticity of ferrocene by giving suitable chemical reaction.

(b) Write down methods of preparation and properties of organolithium compounds.

(c) (i) Explain the transition metal organometallic compound with its examples.

(ii) Write a short note on nomenclature of simple and mixed organometallic compounds.

P.T.O.

- (d) Discuss the methods for preparation of $\text{Ni}(\text{CO})_4$ and explain the structure.
- (e) (i) Draw the structures of $\text{Fe}_2(\text{CO})_9$ and $\text{Ir}_4(\text{CO})_{12}$.
- (ii) Describe mononuclear metal carbonyl with examples.

2. Answer any *three* of the following : 15

- (a) State and explain factors affecting the width of spectral lines.
- (b) State and explain Nernst distribution law and give its limitation.
- (c) Derive the equation for the rate constant of third order reaction.
- (d) The pure rotational spectrum of HCl gaseous molecule consist of series of equally spaced lines separated by 18.60 cm^{-1} . Calculate internuclear distance of the molecule, if the reduced mass is $1.55 \times 10^{-27} \text{ kg}$.

$$h = 6.626 \times 10^{-34} \text{ JS}$$

$$c = 3 \times 10^8 \text{ ms}^{-1} \text{ and } 1 \text{ cm}^{-1} = 10^2 \text{ m}^{-1}$$

- (e) Explain Raman effect. What is Raman shift ?

3. Solve any *two* of the following : 10

- (i) Explain principle and theory of vibrational spectra.
- (ii) State and explain Franck-Condon principle.

- (iii) Explain the kinetics of reversible reaction.
- (iv) When an organic acid was shaken with mixture of benzene and water at constant temperature, the following results were obtained. conc mole/ wt.

Conc. of acid in benzene : C_1 0.036, 0.048, 0.060

Conc. of acid in water : C_2 0.12, 0.16, 0.20.

Comment on result.