

Roll No.

86361

**M. Sc. (Chemistry) 2nd Semester Under
NEP-2020 w.e.f. 2024-25 (Fresh & Re-
appear) Examination – May, 2026**

**INORGANIC CHEMISTRY - II (Inorganic Spectroscopy
and Advanced Inorganic Chemistry)**

Paper : 24CHE202DS01

Time : Three Hours]

[Maximum Marks : 70

*Before answering the questions, candidates should ensure that they have
been supplied the correct and complete question paper. No complaint in
this regard, will be entertained after examination.*

Note : Attempt *five* questions in all, selecting *one* question
from each Section. Question No. 1 is *compulsory*.
All questions carry equal marks.

1. Compulsory question :

- | | |
|--|---|
| (a) Define Larmor frequency. | 2 |
| (b) Define spin-spin coupling. | 2 |
| (c) Write four applications of Wade's rules. | 2 |
| (d) Define Larm0072 Frequency. | 2 |

- (e) What is 18 electron rule ? 2
- (f) Calculate magnetic moment of Mn^{2+} . 2
- (g) What is John-Teller distortion ? 2

SECTION – A

2. (a) Discuss Energy levels in diatomic molecules and selection rule for Electronic Absorption Spectroscopy. 7
- (b) Discuss the applications of IR-spectroscopy in inorganic chemistry. 7
3. (a) Discuss the characterization of metal hydrides complex of $[HRh(CO)_5]^{3-}$ and $[HIr(PMe_2)_2Br_2]^{3-}$. 7
- (b) Describe double resonance in B_2H_6 molecule. Also define the proton exchange effect on NMR-spectrum. 7

SECTION – B

4. Using Wade's rules, predict structure of $[Ru_5N(CO)_{14}]^-$. 14

5. What is isolobal analogy ? Based on isolobal analogy what will be the structure of $[FeC(CO)_{15}]$. 14

SECTION – C

6. (a) Explain faradays method for determination of magnetic susceptibility. Also discuss its advantages and disadvantages. 7
- (b) Calculate values of Linde's factor, μ_J and μ_{eff} of Co^{3+} ion. 7

OR

A Gouy's tube having $\alpha = 0.02$ mg, $\delta = -2.0$ mg and $\beta = 605.23$, was filled with 418.85 g of co-metal (molar mass = 487). The force observed on the sample was 8.0 mg and measurements were done at 27°C. Calculate χ^{corr}_m and no. of unpaired electrons if, the diamagnetic correction is -172×10^{-6} g/atoms.

7. (a) Calculate μ_{eff} of Ni^{2+} in $[Ni(H_2O)_6]^{2+}$ from the data $\alpha = 4$, coupling constant is 649 cm^{-1} & $\Delta_o = 8500 \text{ cm}^{-1}$. 7
- (b) Discuss the Gouy's method for determination of magnetic susceptibility in detail. 7

SECTION - D

8. Calculate the number of microstates for d^3 configuration. Also find out the ground state term for high spin and low spin d^2 configuration. 14
9. (a) With the help of Orgel diagram, discuss the electronic spectra of d^4 configuration. 7
- (b) Briefly discuss electronic spectra of molecular addition compounds of iodine. 7
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**PHYSICAL CHEMISTRY-II (PHYSICAL SPECTROSCOPY
AND ADVANCED PHYSICAL CHEMISTRY)**

Paper : 24CHE202DS02

Time : Three hours]

[Maximum Marks : 70

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt any *five* questions, selecting at least *one* from each unit. Question No 1 is *compulsory*. All questions carry equal marks.

1. (a) Write the symmetry elements associated with eclipsed Ferrocene. $7 \times 2 = 14$
(b) On which factor width of spectral line depends ? Explain.
(c) What do understand by transition probability ?
(d) What is force constant ? How it is determined.
(e) Explain the term "Phosphorescence."

(f) What is polarization ? Explain.

(g) What is the effect of concentration on cell potential ?

UNIT – I

2. (a) What is meant by symmetry element ? Discuss different symmetry elements with example. 7

(b) What is character table ? How it is useful in spectroscopic analysis. 7

3. Write note on the following :

(a) Reducible and irreducible representations 7

(b) Multiplication table and its importance 7

UNIT – II

4. (a) Write a brief note on the following w.r.t Spectroscopy : 3

(i) Resolving Power

(ii) Interaction of matter with electromagnetic radiation 4

(b) Discuss Rotational spectra of a diatomic rigid rotator. 7

5. (a) Exhibit the effect of isotopic substitution on rotational spectra of diatomic molecule. 4

(b) Discuss Vibration spectra of polyatomic molecules. 6

(c) Explain Frank-Condon Principle. 4

UNIT – III

6. Write a brief note on the following : 5, 5, 4
- (a) Charge transfer transitions
 - (b) Fluorescence quenching
 - (c) Life time of excited electronic state
7. (a) Discuss Stern volmer equation. 4
- (b) Discuss techniques for the study of transient species in the photochemical reactions. 5
- (c) Write application of Lasers in photochemical kinetics. 5

UNIT – IV

8. (a) Discuss the concept of junction potential. 6
- (b) What is a Reference electrode? Write its utility ? Give construction of Calomel and silver/silver chloride electrode. 8
9. What do you understand by ion selective electrode. Explain its construction. Write application of ion selective electrode in determination of toxic metals and anions. 14