M.Sc (Previous), Chemistry Syllabus
Semester: I, Course Code:

(For Organic, analytical & physical chemistry)

(w.e.f 2024-25 admitted batch)

Paper- I: INORGANIC CHEMISTRY-I (core course 1)

UNIT-I: Structure & Bonding:

Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pi bonding. Application of MO theory to square planar ($PtCl_4^{2-}$) and Octahedral complexes (CoF_6^{3-}, Co $(NH3)_6$3+). Walsh diagram for H_2O molecule.

UNIT-II: Inorganic Cage and Ring Compounds:

Preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ($H_3B_3N_3H_3$), phosphorus–nitrogen ($N_3P_3Cl_6$) and sulphur-nitrogen (S_4N_4, (SN)x) cyclic compounds. Electron counting in boranes – Wade ‘s rules (Polyhedral skeletal electron pair theory). Isopoly and heteropoly acids.

UNIT-III: Coordination Compounds:

Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series – Jahn – Teller effect, nephelauxetic effect – ligand field theory. Term symbols – Russell – Sander’s coupling – derivation of term symbols for various configurations. Spectroscopic ground states.

UNIT- IV: Electronic Spectra of Transition Metal Complexes:

Selection rules, breakdown of selection rules – Orgel and Tanabe- Sugano diagrams for d^1 – d^9 octahedral and tetrahedral transition metal complexes of 3d series – Calculation of Dq, B and β parameters. Charge transfer spectra. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.

M.Sc. (P) Degree Examination
Semester: I, Paper Code:

(For Organic, analytical & physical chemistry)

(w.e.f 2024-25 admitted batch)

Paper- II: INORGANIC CHEMISTRY-I

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Sl.No.	Unit No.	Unit name	Essay questions (15M)	Short questions (3M)	Total questions
1	I	Structure & Bonding	2	2	4
2	II	Inorganic cage and ring compounds	2	2	4
3	III	Coordination compounds	2	2	4
4	IV	Electronic spectra of transition metal Complexes	2	2	4
Total questions			**8**	**8**	**16**

M.Sc. Degree Examinations
Semester-I, Paper Code:
(Common for Analytical, Organic & Physical chemistry)
(W.e.f. 2024-25 admitted batch)
Paper-I: Inorganic chemistry-I (core paper 1)

Model Question Paper

Time: 3 hours **Maximum Marks: 60M**

Section-A

Answer all questions **(4x10=40M)**

1. i) Explain Walsh diagram for H_2O molecules.
   ii) Applications of VSEPR theory.

OR

2. Draw the MO energy level diagram for $[Co(NH_3)_6]^{3+}$, $[CoF_6]$ and discuss their magnetic properties.
3. Describe the preparation, structure and reactions of Boron-Nitrogen and Sulphur – Nitrogen Cyclic compounds.

OR

4. Write about: i) Homopoly and Heteropoly acids ii) Wades rules
5. Explain the crystal field splitting patters in tetrahedral and Square planar geometries with suitable examples.

OR

6. Discuss: i) Nephelauxetic effect. ii) Russell- Sanders Coupling.
7. Draw the Orgel diagram for $[TiCl_4]^-$ ion and $[Fe(CN)_6]^{3-}$ and explain the electronic transitions.

OR

8. Discuss how Tanabe-Sugano diagrams differ from Orgel diagram? Draw the Tanabe- sugano diagram for $[V(H_2O)]^{3+}$.

Section-B

Answer any five questions. **(5x4=20M)**

9. Write the rules of LCAO method.
10. Predict geometries of XeF_4, SF_4 molecules using VSEPR theory.
11. Write the structure and properties of borazole.
12. Discuss the factors affecting Crystal field splitting energy.
13. Describe the structure and properties of metallo carboranes.
14. Write an account of Spin- Orbital Coupling.
15. Discuss the different types of Paramagnetic behaviours.
16. Write a note on charge transfer spectra.

M.Sc (Previous), Chemistry Syllabus
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Laboratory work (6 hrs. / Week)

Inorganic chemistry practicals –I

Mixture salt micro analysis: Max marks-100 marks (External – 60M + Internal-40M)

1. Qualitative inorganic analysis of mixture salt containing three anions (One Interfering) and three cations (Less familiar) from the following:

Anions: Carbonate, chloride, bromide, Iodide, nitrate, acetate, borate, phosphate, oxalate, tartrate, chromate and sulphate.

Cations: Lead, silver, mercury, copper, cadmium, molybdenum, iron, aluminium, ceric, zirconium, vanadium, zinc, manganese, nickel, cobalt, calcium, strontium, barium, potassium and ammonium & lithium.

2. Preparation of inorganic compounds:

1. Preparation of tetra ammine copper (II) sulphate.
2. Preparation of Tris (Thiourea) cuprous sulphate.

Scheme of valuation for Qualitative inorganic analysis

Max. Marks: 60 **Time: 3 hrs.**

Sl. No	Test	Description	Marks
1.	State		2
2.	Colour		2
3.	Odour		1
4.	Solubility		2
5.	Action of heat		3
6.	Flame test		3
7.	Any two preliminary tests for each anion	For one anion 1+1=2 Three anions 3x2=6	6
8.	Preparation of Sodium carbonate extraction		2
9.	Confirm test for each anion	For one anion: 2 Three anions 3x2=6	6
10.	Elimination of Interfering anion		2
11.	Cations main group separation table		1
12.	Correct cation group report	3x1	3
13.	Analysis of individual cation groups	3x2	6
	Correct Report	For each radical	6
14.	**Total for analysis**		**45**
15.	Viva-voice		5
16.	Record		10
17.	**Total marks**		**60**

- **If ammonium cation present:**
- **With sodium hydroxide solution test -2marks**
- **Nessler's reagent test -2marks**

M.Sc (Previous), Chemistry Syllabus
Semester-I, Course Code:
(Common for M.Sc. Analytical, Physical &Organic chemistry)
(w.e.f 2024-25 admitted batch)
Paper- II: ORGANIC CHEMISTRY-I (core course **2)**

UNIT-I: Nature of bonding in organic molecules and aromaticity 15Hrs

(A) Electronic Effects

Inductive effect, mesomeric effect (Resonance), hyperconjugation, steric effect, tautomerism, acidity and basicity of organic molecules

(B) Criteria of Aromaticity

The Energy Criterion for Aromaticity, Structural Criteria for Aromaticity, Electronic Criteria for Aromaticity, Relationship among the Energetic, Structural, and Electronic Criteria of Aromaticity, Huckle`s rule and MO Theory, aromaticity in benzenoid, non-benzenoid compounds, Aromaticity in Charged Ring Fused-Ring Systems, Heteroaromatic Systems, Annulenes: Cyclobutadiene, Benzene,1,3,5,7-Cyclooctatetraene, [10] Annulenes-1,3,5,7,9-Cyclodecapentaene Isomers, [12], [14], [16] and [18] annulenes, azulenes, fulvenes, fullerenes, ferrocene, anti-aromaticity, homo-aromaticity.

UNIT-II: Reaction Mechanism and Reactive intermediates 15Hrs

(A) Determination of reaction mechanism

Type of reactions with mechanism, Thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammet Equation, Curtin-Hammet Principle, Taft equaton. Potential energy diagrams, Transition states, Intermediates, methods of determining mechanisms, Isotope effects, Linear free energy relationships and their applications.

(B) Reactive intermediates

Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and arynes

UNIT-III: Nucleophilic Substitution reactions 15Hrs

(A) Aliphatic nucleophilic substitutions

S_N1 and S_N2 reactions: mechanism, energy profile diagram, stereochemistry and evidence in favour of the mechanism, SET and Border line (mixed SN^1 and SN^2) mechanisms, Neighbouring group participation, Anchimeric assistance, Nonclassical carbocations, Phenonium ions, Norbornyl system. Factors influencing on nucleophilic substitution reactions: the structure of the substrate, the solvent, the nucleophile and the leaving group.

(B) Aromatic nucleophilic substitution

Aromatic Nucleophilic substitution: SN^2 (Ar) (Addition – Elimination), SN^1(Ar) and benzyne mechanisms (Elimination - Addition); evidence for the structure of benzyne. Von Richter Sommelet-Hauser and Smiles rearrangements.

UNIT-IV: Stereo Chemistry-I **15Hrs**

(A) Molecular representation of organic molecules

Wedge, Fischer, Newman and Sawhorse formula, their description, inter conversion.

(B) Molecular Symmetry and Chirality

Symmetry elements, Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Invertomer, Homomer, Epimer, Anomer, Configuration and Conformation Configurational nomenclature: D, L and R, S nomenclature, Molecules with a single chiralcenter: Tetra and Tri coordinate chiral center, Molecules with two or more chiral centers:constitutionally unsymmetrical and symmetrical molecules.

(C) Geometrical Isomerism

Cis-trans, E, Z- and Syn & anti-nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods, Stability, Cis-trans inter conversion.

Books Suggested:

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Printice Hall)
3. Organic chemistry-Clayden J. (Oxford)
4. Organic Chemistry, Wade, L.G. Jr. 5th Ed. (Pearson)
5. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
6. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row,
   (Publishers, Inc.).
7. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
8. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
9. Organic Chemistry, R. T. Morrison and R. N. Boyd (Prentice-Hall)
10. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
11. Stereochemistry to Organic Compounds, D. Nasipuri, 2nd Ed. (New Age International).
12. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International).

M.Sc. Degree Examination

Semester-I, Course Code:

(Common for M.Sc. Analytical, Physical &Organic chemistry)

(w.e.f 2024-25 admitted batch)

Paper- II: ORGANIC CHEMISTRY-I

Blue Print

Sl.No.	Unit No.	Unit name	Essay questions (15M)	Short questions (3M)	Total questions
1	I	Nature of bonding in organic molecules and aromaticity	2	2	4
2	II	Reaction Mechanism and Reactive Intermediates	2	2	4
3	III	Nucleophilic Substitution reactions	2	2	4
4	IV	Stereo Chemistry-I	2	2	4
Total questions			**8**	**8**	**16**

M.Sc. Degree Examination
Semester-I, Course Code:
(Common for Analytical, Organic & Physical chemistry)
(w.e.f. 2024-25 admitted batch1
Paper-II: Organic chemistry-I
Model Question Paper

SECTION-A

Answer **ALL** Questions (4x10=40 Marks)

1. Write about the following (4+4+2)
   i) Inductive effect ii) Mesomeric effect iii) Hyperconjugation

OR

2. Write about the following (6+4)
   i) What are annulenes? Discuss the aromaticity of [10],[14] and [18] annulenes?
   ii) Explain aromaticity in azulenes and fulvenes
3. i) Explain thermodynamic and kinetic control reactions with examples (6+4)
   ii) How does isotopic labeling help in establishing the mechanism of a reaction?

OR

4. Explain the structure, stability and reactions of carbocations, carboanions and carbenes
5. Write about the following (4+6)
   i) What is anchimeric assistance? How do you distinguish phenomium ions from non-carbocations? Discuss give appropriate examples.
   ii) Explain factors that influence the nucleophilc substitution reactions

OR

6. Write the reaction and mechanisam of (5+5)
   i) Von Richter Rearrangement ii) Sommelet-Hauser Rearrangment
7. Write about the methods of determining configuration of Geometrical isomers using Physical, spectral and chemical methods. (10M)

OR

8. Write CIP rules and assign the R, S configurations with suitable examples

SECTION-B

Answer any **FIVE** of the following (5x4=20 Marks)

9. i)What is tautomerisam and write the examples

   ii) Why carboxylic acids are more acidic than phenols?

10. i) Explain why tropone possess high dpole moment?

    ii) Define Antiaromaticity and Homoaromaticity

11. Write about Taft equation and Hammett equation?
12. Explain structure and stability of carbine and nitrene

13. i)Write nucleophilic substitution reactions of allyl halides

    ii) Trans-2- chloro cyclohexanol gives epoxy cyclohexane in high yield on treat with base where as cis isomer does not react in the way. Explain why?

14. Explain the mechanism involved in aromatic nucleophilic substitution reactions
15. Defint the following with suitable examples
    i) Enantiomers ii) Diastereomers
16. Write a short note on i) Cis- Trans Isomerism ii) E-Z Nomenclature

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