

Sri Venkateswara University, Tirupati

**Syllabus for Chemistry (Major) in consonance with Curriculum frame work
(W.E.F. AY-2026-27)**

COURSE STRUCTURE (for Semesters III)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	III	5	Organic Chemistry – II (Halogenated Hydrocarbons and Oxygen Containing Functional Groups)	3	3
			Organic Qualitative Analysis	2	1
		6	Physical Chemistry – II (Solutions and Electrochemistry)	3	3
			Physical Chemistry – II Practical	2	1
		7	Coordination Chemistry	3	3
			Preparation of Coordination Compounds	2	1


(BOS Chairman)
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SEMESTER-III

COURSE 7: COORDINATION CHEMISTRY

Theory

Credits: 3

3 hrs/week

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I. LEARNING OBJECTIVES:

1. Understand the nomenclature, structure and isomerism of coordination compounds.
2. Apply VBT and CFT to explain bonding, geometry, magnetism, and reactivity in coordination complexes.
3. Analyze the stability of metal complexes using kinetic and thermodynamic principles.
4. Interpret the properties of organometallic compounds, especially metal carbonyls, using MO theory and the 18-electron rule.
5. Explore the roles of metal ions in biological systems and understand their physiological and toxicological effects.

II. COURSE OUTCOMES:

At the end of the course, the student will be able to:

1. Classify ligands and write IUPAC names of coordination compounds.
2. Explain VBT and CFT concepts to predict structures of complexes.
3. Analyze substitution mechanisms and assess kinetic/thermodynamic stability of complexes.
4. Describe bonding, electron count and synergic bonding in metal carbonyls.
5. Examine the biological roles and toxicity of metal ions and apply chelation in medicine.

III. SYLLABUS:

UNIT-1: COORDINATION CHEMISTRY-I

(9 h)

Definition of coordination compound, types of Ligands-IUPAC nomenclature of Coordination compounds, structural and stereo isomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Postulates- magnetic properties- Inner and outer orbital complexes - Limitations of VBT.

UNIT-2: COORDINATION CHEMISTRY-II

(9 h)

Crystal Field Theory: Postulates of CFT, Splitting in Octahedral and tetrahedral fields. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Factors affecting the crystal field splitting energy, Spectrochemical series.

UNIT-3: INORGANIC REACTION MECHANISM AND STABILITY OF COMPLEXES (9 h)

Inorganic Reaction Mechanism: Labile and inert complexes, Substitution reactions in square planar complexes, Trans-effect and its applications, Cisplatin as an anti-cancer drug.

Stability of metal complexes: Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method.

UNIT- 4: ORGANOMETALLIC COMPOUNDS- METAL CARBONYLS (9 h)

Definition and classification of organometallic compounds based on bond type.

Metal carbonyls: General methods of preparation of metal carbonyls of 3d series, 18-electron rule, electron count of mononuclear and polynuclear carbonyls. Structures of mononuclear and binuclear carbonyls of Cr, Fe, Co and Ni using VBT, π -acceptor behaviour of CO, synergic effect.

UNIT- 5: BIOINORGANIC CHEMISTRY (9 h)

Metal ions present in biological systems, classification of elements according to their action in biological systems. Na / K- pump, carbonic anhydrase and carboxypeptidase. Toxicity of metal ions (Hg, Pb, and As) and reasons for toxicity, Use of chelating agents in medicine. Haemoglobin - transfer of oxygen, Myoglobin-Storage and transfer of iron.

IV. REFERENCES:

1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller, F.A. Armstrong, Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press, 2010.
2. G.L. Miessler, P.J. Fischer, D.A. Tarr, Inorganic Chemistry, 5th Edition, Pearson, 2014.
3. J.E. Huheey, E.A. Keiter, R.L. Keiter, O.K. Medhi, Inorganic Chemistry- Principles of Structure and Reactivity, Pearson Education, 2009.
4. B.W. Pfennig, Principles of Inorganic Chemistry. John Wiley & Sons, 2015.
5. F.A. Cotton & G. Wilkinson, Advanced Inorganic Chemistry Wiley-VCH, 1999.
6. J.D. Lee, **Concise Inorganic Chemistry**, Oxford University Press, 2008.

V. PROPOSED ACTIVITIES:

1. Worksheet on writing IUPAC names and isomer structures of complex compounds.
2. Electron-count assignments of metal carbonyls.
3. Chart: Role of metal ions in enzymes and metal toxicity.
4. Group project: Use of chelating agents in medicine

VI. CO-CURRICULAR ACTIVITIES AND ASSESSMENT METHODS:

1. Continuous Internal Evaluation (CIA): Monitoring the progress of student's learning
2. Class Tests, Worksheets, Quizzes, Industrial/Field visits, Student seminars, Poster and PPT presentations, Peer learning, Project-based learning, Assignments, Debates, Group Discussions: Enhances critical thinking skills.
3. Semester End Examination (SEE): Critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

SEMESTER-III

COURSE 7: PREPARATION OF COORDINATION COMPOUNDS

Practical

Credits: 1

2 hrs/week

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I. LEARNING OBJECTIVES:

1. To develop safe laboratory practices and chemical handling procedures.
2. To synthesize and isolate coordination compounds.
3. To determine the composition of a metal-ligand complex in solution.

II. COURSE OUTCOMES:

At the end of the course, the student will be able to:

1. Synthesize and purify coordination compounds.
2. Understand coordination numbers, geometries, and ligand types.
3. Demonstrate methods of complex preparation and analysis.
4. Apply Job's method to determine stoichiometric ratios of complexes.

III. SYLLABUS:

1. Preparation of Tetraamminecopper (II) sulphate.
2. Preparation of Potassium tri(oxalato)ferrate(III).
3. Preparation of hexaamminecobalt(III) chloride.
4. Preparation of Acetylacetonate complexes of $\text{Cu}^{2+}/\text{Fe}^{+3}$.
5. Determination of the stoichiometry of a metal-ligand complex by the Jobs method.

IV. REFERENCES:

1. James E. Huheey, Inorganic Chemistry: Principles of Structure and Reactivity, Harper Collins College Publishers, 1993.
2. Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2000.
3. R. Gopalan, P.S. Subramanian, Elements of Analytical Chemistry, Sultan Chand & Sons, 3rd Edition, 2003.
4. G. Svehla, Vogel's Qualitative Inorganic Analysis, 7th Edition, Prentice Hall, 1996.

V. CO-CURRICULAR ACTIVITIES AND ASSESSMENT METHODS:

1. Internal Practical Assessment
2. Lab Record Evaluation
3. Final Practical Examination
4. Oral/Viva Voce

4- Year UG Honours, Major
Syllabus
(2026-27)
Semester-III

Model Question Paper

Time : 3hrs

Marks:75

Part-A

Answer any Five Questions. Each Question carries 3 Marks.

5x3=15

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Answer the following questions. Each question carries 12 Marks

5x12=60

11. a) Unit-I
(Or)
b) Unit-I

12. a) Unit-II
(Or)
b) Unit-II

13. a) Unit-III
(Or)
b) Unit-III

14. a) Unit-IV
(Or)
b) Unit-IV

15. a) Unit-V
(Or)
b) Unit-V