

**Govt. T. R. S. (Autonomous) College Rewa (M.P.)**  
**Department of Chemistry**  
**Syllabus for B.Sc. Chemistry**  
**(CBCS & NEP 2020)**  
**Session 2022-23**

Part A - Introduction				
Program-B.Sc. Hons		Class- UG	Semester- II	Session: 2022-2023
Subject : Chemistry				
1	Course code	CHGT-02 A		
2	Course title	TRANSITION METAL & COORDINATION CHEMISTRY		
3	Course type	Generic Elective (GE)		
4	Pre-requisite (if any)	This course is Open for all		
5	Course Objective	The course introduces the students to coordination compounds which find manifold applications in diverse areas like qualitative and quantitative analysis, metallurgy, as catalysts in industrial processes as medicines, paints and pigments as well as in life. The student is also familiarized with the d and f block elements and get an idea about horizontal similarity in a period in addition to vertical similarity in a group.		
6	Course Learning Outcomes (CLO)	<p><b>By the end of the this paper Students will be able to:</b></p> <ul style="list-style-type: none"> <li>• Understand the terms, ligand, denticity of ligands, chelate, coordination number and use standard rules to name coordination compounds.</li> <li>• Discuss the various types of isomerism possible in such compounds and understand the types of isomerism possible in a metal complex.</li> <li>• Use Valence Bond Theory to predict the structure and magnetic behaviour of metal complexes and understand the terms inner and outer orbital complexes</li> <li>• Explain the meaning of the terms <math>\Delta_o</math>, <math>\Delta_t</math>, pairing energy, CFSE, high spin and low spin and how CFSE affects thermodynamic properties like lattice enthalpy and hydration enthalpy</li> <li>• Explain magnetic properties and colour of complexes on basis of Crystal Field Theory</li> <li>• Understand the important properties of transition metals like variable oxidation states, colour, magnetic and catalytic properties and use Latimer diagrams to predict and identify species which are reducing, oxidizing and tend to disproportionate and calculate skip step potentials</li> <li>• Understand reaction mechanisms of coordination compounds and differentiate between kinetic and thermodynamic stability.</li> </ul>		
7	Credit Value	4		
8	Total Marks	Maximum Marks: Total - 100 University Exam (UE)- 60, CCE-40		Min. Passing Marks: 33

**Part B – Content of the Course**

**Total No. of Lectures-Tutorials-Practical (04 hours per week):**

**L-T-P: 45-0-0 (Total hours)**

<b>Unit</b>	<b>Topic</b>	<b>No. of Lectures</b>
<b>1</b>	<b>Transition Elements (3d series)</b> General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu. Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).	12
<b>2</b>	<b>Coordination Chemistry</b> Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC system of nomenclature.	08

3	<p><b>Crystal Field Theory</b>  Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.</p>	10
<b>Part C – Learning Resource</b>		
<b>Text Books, Reference Books, Other Resources</b>		
<p><b>Suggested Reading:</b>  <b>Text &amp; Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Kotz, J.C., Treichel, P.M. &amp; Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009)</li> <li>2. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).</li> <li>3. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).</li> <li>4. Cotton, F.A. &amp; Wilkinson, G. Basic Inorganic Chemistry, Wiley.</li> <li>5. Shriver, D.F. &amp; Atkins, P.W. Inorganic Chemistry, Oxford University Press.</li> <li>6. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.</li> <li>7. Rodgers, G.E. Inorganic &amp; Solid State Chemistry, Cengage Learning India Ltd., 2008.</li> </ol> <p><b>Suggested equivalent online courses:</b>  (all URLs accessed in May 2021)</p>		

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**Session 2022-23**

Part A - Introduction				
Program-CERTIFICATE		Class- UG	Semester- First	Session: 2022-2023
Subject : Chemistry				
1	Course code	CHGP 02		
2	Course title	TRANSITION METAL & COORDINATION CHEMISTRY PRACTICAL		
3	Course type	Generic Elective (GE)		
4	Pre-requisite (if any)	This course is Open for all		
5	Course Objective	<ul style="list-style-type: none"> <li>• <u>To develop interest to identify different inorganic preparations.</u></li> <li>• <u>To eliminate the confusion related to inorganic reactions.</u></li> <li>• <u>To develop experimental complex awareness.</u></li> <li>• <u>To eliminate the fear related to spectroscopic instruments.</u></li> </ul>		
6	Course Learning Outcomes (CLO)	<b>By the end of the this paper Students will be able to:</b> <ul style="list-style-type: none"> <li>• Estimate inorganic elements in form complex.</li> <li>• Prepare inorganic complex in laboratory.</li> <li>• Use instruments related to inorganic experiments carefully.</li> </ul>		
7	Credit Value	02		
8	Total Marks	Maximum Marks: Total - 100 University Exam (UE)- 60, CCE-40		Min. Passing Marks: 33
Part B – Content of the Course				
<b>Total No. of Lectures-Tutorials-Practical (04 hours per week):</b>				
<b>L-T-P: 15-0-0 (Total hours)</b>				
Unit	Topic		No. of Lectures	
1	1. Semi-micro qualitative analysis (using H <sub>2</sub> S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following: <ol style="list-style-type: none"> <li>a. <b>Cations</b> : NH<sub>4</sub><sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup></li> <li>b. <b>Anions</b> : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>4</sub><sup>2-</sup>, S<sub>2</sub>O<sub>3</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup></li> </ol>		15	

	<p style="text-align: center;">, <math>\text{NO}_3^-</math>, <math>\text{SO}_4^{2-}</math>, <math>\text{PO}_4^{3-}</math>, <math>\text{BO}_3^{3-}</math>, <math>\text{C}_2\text{O}_4^{2-}</math>, <math>\text{F}^-</math></p> <p>c. Spot tests should be carried out wherever feasible.</p> <p>2. Estimate the amount of nickel present in a given solution as bis (dimethylglyoximate) nickel (II) or aluminium as oximate in a given solution gravimetrically.</p> <p>3. Estimation of (i) <math>\text{Mg}^{2+}</math> or (ii) <math>\text{Zn}^{2+}</math> by complexometric titrations using EDTA.</p> <p>4. Estimation of total hardness of a given sample of water by complexometric titration.</p>	
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### Part C – Learning Resource

#### Text Books, Reference Books, Other Resources

- Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
- Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
- Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).