

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction

Program: Bachelor in Science (Diploma/Degree/Honors)		Semester - III	Session: 2024-2025
1	Course Code	CHSC-03T	
2	Course Title	INORGANIC AND PHYSICAL CHEMISTRY-I	
3	Course Type	DSC	
4	Pre-requisite(if,any)	<i>As per Program</i>	
5	Course Learning, Outcomes(CLO)	<ul style="list-style-type: none"> ➢ Understand fundamental chemical concepts of transition elements and their applications. ➢ Master the principles of coordination chemistry. ➢ Grasp the core principles of thermodynamics and apply them to various phenomena. ➢ Explore the world of electrochemistry and its applications. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours -learning & Observation</i>
7	Total Marks	Max.Marks: 100	Min Passing Marks:40

PART -B: Content of the Course

Total No. of Teaching-learning Periods(01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics(Course contents)	No. of Periods
I	<p>Chemistry of d & f-block elements</p> <p>A. d-block elements (5 hrs.)</p> <p>(i) Chemistry of elements of first transition series: Characteristic properties of the elements of first transition series with reference to their: Electronic configuration, Atomic and ionic radii, Ionization potential, Variable oxidation states, Magnetic properties, Color, Complex formation tendency and catalytic activity.</p> <p>(ii) Chemistry of elements of second and third transition series: Electronic configuration of 4d and 5d transition series. Comparative treatment with their 3d-analogous (Group Cr- Mo-W, Co-Rh-Ir) in respect of oxidation states and magnetic behavior.</p> <p>B. f-block elements (6 hrs.)</p> <p>Chemistry of Lanthanide & Actinides: Electronic structure, oxidation states, ionic radii, magnetic, and spectral properties. Lanthanide contraction and its consequences, complex formation, occurrence and isolation, Separation of lanthanides: solvent extraction and ion exchange method. General features and chemistry of actinides, Transuranic elements, chemistry of separation of Np, Pu and Am from uranium, similarities between the later actinides and the later lanthanides.</p>	12
II	<p>Oxidation and reduction (5 hrs)</p> <p>Various definitions of oxidation and reduction, Balancing of redox reaction by ion-electron method, Latimer diagram of Chlorine and Oxygen, Frost diagram of Nitrogen and Oxygen, and Pourbaix diagrams of Iron. Predicting disproportionation and comproportionation phenomena.</p> <p>Coordination Chemistry (6 hrs)</p> <p>A. Coordination compounds: Distinction among simple salts, double salts, and coordination compounds. Terminology and nomenclature of Coordination</p>	11

	<p>compounds. Types of ligands based on denticity. Werner's Coordination theory and its experimental verification. Sidgwick's electronic interpretation, EAN rule with examples. Electroneutrality principle, Valence Bond Theory of transition metal complexes. Determination of structures and magnetic properties of complexes based on VBT. Chelates: Classification and their application.</p> <p>B) Isomerism in coordination compounds: Structural isomerism and Stereoisomerism (Geometrical and optical) in coordination compounds with four and six coordination numbers.</p>	
III	<p>Thermodynamics-I: (5 hrs)</p> <p>A. Basic concept of thermodynamics: System, surrounding, types of system (closed, open & isolated). Intensive & extensive properties. Thermodynamic processes: isothermal, adiabatic, isobaric, isochoric, cyclic, reversible & irreversible. State function & path functions and their differentiation, concept of heat & work. Zeroth law of thermodynamics, First law of thermodynamics. Definition of internal energy & enthalpy. Concept of heat capacity, heat capacity at constant volume & at constant pressure, and their relationship.</p> <p>Joule-Thomson experiment, Joule-Thomson coefficient (no derivation) & inversion temperature. Calculations of w, q, E & H for expansion of gases for isothermal & adiabatic conditions for reversible process.</p> <p>B. Thermochemistry(2 hrs.)</p> <p>Standard states, Heat of reaction, enthalpy of formation, enthalpy of combustion, enthalpy of solution, enthalpy of neutralization, Hess's law of constant heat of summation & its applications. Variation of enthalpy change of reaction with temperature (Kirchoff's equation).</p> <p>C. Thermodynamics II (4 hrs.)</p> <p>Second law of thermodynamics: Limitations of first law and need for the second law. Statements of second law. Carnot cycle & Efficiency of heat engine. Thermodynamic principle of working of a refrigerator (Carnot theorem). Concept of entropy: entropy change in a reversible and irreversible process; entropy change in isothermal reversible expansion of an ideal gas. Physical significance of entropy. Gibbs free energy, Gibbs -Helmholtz equation.</p> <p>D. Third law of thermodynamics (1 hr)</p> <p>Statement of third law, Nernst heat theorem, Absolute entropy of solids, liquids, and gases.</p>	12
IV	<p>Electrochemistry-1</p> <p>Electrolyte conductance: specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titrations.</p> <p>Single electrode potential, standard electrode potential, electrochemical series and its applications. Concept of overvoltage.</p> <p>Theory of strong electrolyte: limitation of Ostwald's dilution law weak and strong electrolyte, Debye-Hückel-Onsager's (DHO) equation for strong electrolytes, relaxation, and electrophoretic effect.</p> <p>Migration of ions: Transport number-definition and determination by Hittorf method and moving boundary method.</p> <p>Electrochemical cells or Galvanic cells: reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell, effect of temperature on EMF of cell, Nernst equation calculation of ΔG, ΔH and ΔS for cell reaction, polarization, Over potential and hydrogen overvoltage.</p>	11

Keywords *D & f-block elements, Coordination compounds, Werner's theory, VBT, Isomerism, Thermodynamics, Thermochemistry, Electrical/electrolytical conductance, Transport number.*

*Dr. D. S. Bhatia
Dr. K. S. Shrivastava
Dr. M. S. Chauhan
Dr. S. K. Singh
Dr. S. K. Singh
Dr. S. K. Singh
Dr. S. K. Singh
Dr. S. K. Singh*

Signature of Convener & Members (CBoS) :

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended -

Books Recommended –

1. Jauhar, S. P. (2010). *Modern Approach to Inorganic Chemistry: A Textbook for B. Sc. I Students.* Modern publishers
2. Bajpai, D. N. (1992). *Advanced book of physical chemistry.* S Chand publishing.
3. Sharma, k. K. & Sharma, L. K. (2016). *A textbook of physical chemistry.* Vikas publishing.
4. Bhasin, K. K. (2018). *Pradeep's Inorganic Chemistry Vol.III.* Pradeep publications.
5. Puri, S., & Sharma, L. R. (2008). *Kalia "Principles of Inorganic Chemistry".*

Reference Books recommended-

Inorganic Chemistry

1. Lee, J. D. (2008). *Concise inorganic chemistry*. John Wiley & Sons.
2. Cotton, F. A., Wilkinson, G., & Gaus, P. L. (1995). *Basic inorganic chemistry*. John Wiley & Sons.
3. Huheey, J. E., Keiter, E. A., Keiter, R. L., & Medhi, O. K. (2006). *Inorganic chemistry: principles of structure and reactivity*. Pearson Education India.
4. Douglas, B. E., McDaniel, D. H., & Alexander, J. J. (1994). *Concepts and models of inorganic chemistry*, John Wiley & Sons

Physical Chemistry

1. Puri, L. B., Sharma, L. R., & Pathania, M. S. (2013). *Principles of physical chemistry*. Vishal Publishing Co.
2. Atkins, P. W., De Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry*. Oxford university press.
3. McQuarrie, D. A., & Simon, J. D. (2004). *Molecular Thermodynamics* Viva Books Pvt. Ltd : New Delhi.

Online Resources—

- e-Resources / e-books and e-learning portals
- <https://www.geeksforgeeks.org/d-block-elements/>
- <https://www.vedantu.com/evs/lanthanides-vs-actinides>
- <https://www.livescience.com/50776-thermodynamics.html>
- <https://byjus.com/jee/electrochemistry/>

Online Resources

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PART -D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment(CIA):30 Marks

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End Semester Exam (ESE): 70 Marks

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Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 10 20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:

Levi H. Shulman Dr. J. F. Shy
Indira Gandhi