PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

Course Code				**23CHMAL234**			
Title of the Course				**INORGANIC AND PHYSICAL CHEMISTRY**			
Offered to: (Programme/s)				B.Sc. Hons Chemistry			
L	**4**	**T**	**0**	**P**	**0**	**C**	**3**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	Major			**Course Relates to:**	Global		
Year of Revision:	**-**			**Percentage:**			
Type of the Course:				Employability			
Crosscutting Issues of the Course :				Professional Ethics			
Pre-requisites, if any				**23CHMAL121, 23CHMAL122**			

Course Description: Inorganic and physical chemistry are two fundamental branches of chemistry, each focusing on different aspects of chemical science. Understanding the intersection and distinctions between these fields is crucial for a comprehensive grasp of chemistry inorganic chemistry focuses on the study of inorganic compounds and materials, while physical chemistry deals with the physical principles and theories underlying chemical processes. Together, they provide a comprehensive understanding of both the substances and the phenomena that occur in chemical reactions.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To learn nomenclature of co-ordinated complexes and various theories, structure and stereo chemistry of coordinationcompounds.
2	To Apply IUPAC nomenclature for complexes of Coordination compounds
3	To Learn labile and inert complexes and in organic reaction mechanism and stability of complexes
4	To understand the relationships between heat, work, and energy. It provides a framework for understanding how energy is transferred and transformed in physical and chemical processes.
5	To learn how to apply thermodynamic concepts such as enthalpy, entropy, and Gibbs free energy to predict the feasibility and direction of chemical reactions and phase changes.

Course Outcomes

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

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Apply IUPAC nomenclature for Coordination compounds	**K3**	**PO2**	**PSO3**
CO2	Understand the various theories, structure and stereo chemistry of coordination compunds	**K2**	**PO2**	**PSO2**
CO3	Understand the basic concepts of thermodynamics.	**K2**	**PO2**	**PSO2**
CO4	Remember the reaction mechanism in complexes	**K1**	**PO7**	**PSO2**
CO5	Apply the 18 electron rule in inorganic chemistry.	**K3**	**PO7**	**PSO3**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX										
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1		**2**								**1**
CO2		**3**							**2**	
CO3		**2**							**2**	
CO4							**3**		**3**	
CO5							**2**			**2**

Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Syllabus

Unit I Coordination Chemistry-I (9 h)

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, CFT-Postulates Splitting in Octahedral, tetrahedral, tetragonal and square planar fields. Crystal field stabilization energy(CFSE), Crystal field effects for weak and strong fields. Factors affecting the magnitude of crystal field splitting energy, Spectro chemical series, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion.

UNIT–II Coordination Chemistry II (9 h)

1. Inorganic molecular Reaction Mechanism: **(6 h)**

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions – SN_1 and SN_2, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications

2. Stability of metal complexes: (3 h)

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

Unit III Organo metallic compounds (9 h)

Definition and classification of organo metallic Compounds on the basis of bond type, Metalcarbonyls:18electron rule, electron count of mononuclear, poly nuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. π-acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

Unit IV Thermodynamics- I (9 h)

Concept of heat(q), work(w), internal energy(U), State function and Path function- statement of first law; enthalpy(H), relation between heat capacities, calculations of q, w, U and H for reversible, irreversible processes, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. Temperature dependence of enthalpy of formation- Kirchoff's equation.

Unit V Thermodynamics II (9 h)

State function and Path function Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs equation - Criteria for spontaneity.

I. List of Reference Books:

1) Concise coordination chemistry by Gopalan and Ramalingam
2) Coordination Chemistry by Basalo and Johnson
3) Text book of physical chemistry by S Glasstone
4) Concise Inorganic Chemistry by J.D.Lee
5) Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
6) A Text Book of Physical Chemistry by K.L.Kapoor Vol 2, 6th edition, 2019.

References-weblinks

1. https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Inorganic_Chemistry_(LibreTexts)/09%3A_Coordination_Chemistry_I_-_Structure_and_Isomers
2. https://utkaluniversity.ac.in/wp-content/uploads/2022/03/Inorg_React_Mech_NDas.pdf
3. https://www.britannica.com/science/organometallic-compound
4. https://www.visionlearning.com/en/library/Physics/24/Thermodynamics-I/200
5. https://dampiitbche.wordpress.com/2021/07/08/cl-250-chemical-engineering-thermodynamics-ii-s2/

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SEMESTER -END QUESTION PAPER

Course Code & Title of the Course:	**23CHMAL234 INORGANIC AND PHYSICAL CHEMISTRY**
Offered to:	B.Sc. Hons Chemistry
Category: MAJOR	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks)

Answer All questions. Each question carries 4 Marks.

Q1 (a) Describe structural isomerism in coordination complexes K1

OR

(b) Discuss the Jahn-Teller distortion in square planar complexex. K1

Q2 (a) Define trans effect and write any of its two applications K1

OR

(b)Define chelates and effect of chelate in stability of comoplexes. K1

Q3 (a) Describe 18electron rule with an example. K2

OR

(b) explain π-acceptor behaviour of CO K2

Q4 (a) Explain Joule-Thomson effect K2

OR

(b) Describe State function and Path function K2

Q5 (a) Illustrate the Concept of entropy. K3

OR

(b)Explain Third law of thermodynamics K3

Section B: Long Answer Questions (50 Marks)

Answer all questions. Each question carries 10 Marks.

Q6 (a) Explain postulates of Valence Bond Theory and Inner and outer orbital complexes. K2

OR

(b) Describe crystal field Splitting in Octahedral and tetrahedral complexes K2

Q7 (a) Explain ligand substitution reactions in square planar complexes. K2

OR

(b) Explain the following .

i) factors affecting the stability of metal complexes

ii) determination of composition of complex by Job's method K2

Q8 a) Define organo metallic compounds and give its classification K3

OR

(b) Give general methods of preparation of mono and binuclear carbonyl compounds. K3

Q9 (a) Calculate work for the expansion of perfect gas under isothermal and adiabatic conditions K3

OR

(b) Explain following K3

i) Temperature dependence of enthalpy

ii) Kirchoff's equation.

Q10 (a) Explain Carnot theorem and construct Carnot cycle and its efficiency K3

OR

(b) Explain the following

i) Nernst heat theorem for Spontaneous and non- spontaneous processes.

ii) Derivation of Helmholtz and Gibbs equation K3