

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: VI

**CHEMISTRY PAPER VII
INORGANIC CHEMISTRY**

Course Code: 18VICH7

No. of Hours: 45

COURSE OBJECTIVES:

By the end of the course students should be able to understand and explain

- The key features of coordination compounds, crystal field Theory, the shapes and structures of coordination complexes, the stability of metal complexes, the types of isomers in coordination compounds, IUPAC nomenclature of coordination compounds, some applications of coordination compounds.
- The versatile nature of the metal carbon bond and its subsequent application in catalysis.
- The role of metal ions and metal containing compounds in biological systems.
- The use of industrially and commercially important materials and the correlation between their structure and properties.
- Synthesis and applications of nano materials, a frontier area of research today.
- The principle and application of Complexometric titrations using EDTA and gravimetric analysis in the quantitative analysis of transition metals like Ni, Zn, Cu, Fe etc. (the laboratory component)

LEARNING OUTCOMES:

On completion of this course, the student should be able to:

- Write the IUPAC name and understand the principles of structure of coordination compounds.
- Discuss role of different metals in biological processes.
- Link an organometallic catalyst to a specific reaction.
- Describe the use of materials in industrial processes.
- Apply the principles of synthesis of new materials in eventual research and development.
- Identify a suitable volumetric, gravimetric or a colorimetric estimation for the analysis of Ni, Zn, Fe, Cu, Ca, Mg and Ba.

UNIT I

Chapter 1 CO-ORDINATION COMPOUNDS

10 HRS

Ligands: Classification and nomenclature. Coordination number. Nomenclature of coordination compounds. Theories of structure and bonding : Valence bond theory, crystal field theory (tetrahedral, square planar, octahedral complexes). Crystal field splitting and crystal field stabilization energies. Magnetic properties of $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{Fe}(\text{CN})_6]^{3-}$. Spectral properties of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{CoCl}_4]^{2-}$.

ISOMERISM

Structural isomerism : Ionization, Hydrate, Coordination and Linkage isomerism with examples.

Stereoisomerism : geometric isomerism - MA_2B_2 , MA_2BC , MA_4B_2 , MA_3B_3 with examples.
Optical isomerism - $MA_2B_2C_2$, $M(AA)_2B_2$, $M(AB)_3$ with examples.

Applications of coordination compounds : cis-platin in cancer therapy, $Na_2CaEDTA$ in treatment of lead poisoning and British anti lewisite in treatment of Hg poisoning.

UNIT II

Chapter 2 ORGANOMETALLIC COMPOUNDS AND CATALYSIS 10 HRS

Ligands: Classification (hapticity).

Synthesis, structures and stability (eighteen electron rule) : $K [PtCl_3 \eta^2-C_2H_4]$, $[Fe(\eta^5-C_5H_5)_2]$, $[Cr(\eta^6-C_6H_6)_2]$, $W(\eta^1-CH_3)_6$ and metal carbonyls – $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$, $Co_2(CO)_8$, $Mn_2(CO)_{10}$.

Homogeneous catalysis by transition metal complexes with mechanism: Olefin hydrogenation - Wilkinson's Catalyst, Acetic acid from ethylene – Wacker Process

Heterogeneous catalysis and mechanism: use of Ziegler – Natta catalyst in polymerization of ethene.

Introduction to palladium catalyzed cross coupling reaction by Heck, Negishi and Suzuki (Nobel laureates in chemistry 2010).

UNIT III

Chapter 3 BIO-INORGANIC CHEMISTRY 06 HRS

Role of essential and trace elements in biological processes. Bonding and structure of metallo-porphyrins with special reference to haemoglobin and myoglobin. Biological role of sodium, potassium, magnesium, calcium, cobalt, manganese, molybdenum, zinc and copper ions.

UNIT IV

Chapter 4 INDUSTRIAL MATERIALS 12 HRS

Refractories - properties, classification, determination of PCE values.

Abrasives - classification, applications, hardness, manufacture and importance of carborundum, alundum and tungsten carbide.

Glass : properties, types, manufacture of soda glass. Composition and uses of borosilicate and optical glasses. Safety glass - fire and bullet proof glasses and applications.

Ceramics : raw materials, varieties of clay, production of ceramic ware, glazing, insulators.

Cement : raw materials, grades, manufacture of Portland cement by setting process.

Pigments : Lithopone and titanium white - manufacture and relative merits. White lead and its disadvantages.

Paints and varnishes : constituents of oil paints, emulsion paints, varnishes and their role.

Fuels : characteristics, calorific value and its determination using bomb calorimeter.

Coal: varieties, production of coke from coal.

Gaseous fuels-advantages, constituents and their significance. Production of coal gas and LPG. Octane number. Biofuels.

Explosives : classification, preparation of dynamite and TNT.

Propellants : characteristics, classification.

UNIT V

Chapter 5 CHEMISTRY OF NEWER MATERIALS

07 HRS

Conducting polymers: Definition and Examples. Conducting polyanilines, polyacetylenes. Doping. Properties: electroluminescence, elasticity, high electrical conductivities. Applications - engineering and biological.

Nanomaterials: introduction, methods of preparation – sol gel synthesis, inert gas condensation, mechanical alloying and hydrothermal. Applications - environmental, medicinal, optical and electrical properties.

REFERENCES:

1. F. Albert Cotton, Geoffery Wilkinson, Paul. L. Gaus, Basic Inorganic Chemistry, 3rd Edition, 2003, John Wiley & Sons (ASIA) P. Ltd.
2. William L. Jolly, Modern Inorganic Chemistry, 2nd Edition, 2007, Tata McGraw-Hill.
3. W. Malik, G.D. Tuli, R.D. Madan, Selected Topics in Inorganic Chemistry, 3rd Edition, 1984, S. Chand & Company Ltd.
4. P. K. Bhattacharya, Metal ions in Bio-chemistry, 2005, Narosa Publishing House, New Delhi.
5. R. Chang, Essential Chemistry, 1996, McGraw Hill Co.
6. C.M.P. Mingos, Essential Trends in Inorganic Chemistry, 1998, Oxford Univ. Press
7. V R Kulkarni and K Ramakrishna Reddy, 2016, Engineering Chemistry, New age international publishers.

CHEMISTRY PRACTICAL

VI SEMESTER - PAPER VII (INORGANIC)

DURATION: 3 HRS / WEEK

NO. OF UNITS: 15

I Volumetric estimation

1. Determination of percentage of iron in haematite using diphenyl amine as an internal indicator.
2. Determination of calcium in limestone.
3. Determination of copper in brass.
4. Estimation of zinc using standard EDTA and eriochrome black-T as indicator.
5. Estimation of nickel using standard EDTA by back titration.
6. Determination of total hardness of water using EDTA.

II Gravimetric estimation

7. Estimation of sulphate as BaSO_4 .
8. Estimation of nickel as nickel dimethylglyoximate.
9. Estimation of magnesium as magnesium oxinate.

III Colorimetric estimation

10. Estimation of Fe(II) using *o*-phenanthroline.
11. Estimation of copper as cuprammoniumsulphate.

Repetition and Tests.

REFERENCES:

1. G. Marr. And B.W. Rackett, Practical Inorganic Chemistry, 1992, Von Nostrand Reinhold.
2. Arthur I. Vogel, A Text book of Quantitative Inorganic Analysis including Elementary Instrumental Analysis, 3rd Edition, 1988, ELBS & Longman.