T.Y B.Sc. CHEMISTRY (3units)

# Choice Based Credit System

**SEMESTER V**

**INORGANIC CHEMISTRY**

**COURSE CODE: USCH502 CREDITS: 01 LECTURES: 30**

| **(**Numericals and word problems are expected) | |
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| **UNIT-I** | **L/Week** |
| **1. Molecular Symmetry and Chemical Bonding** | |
| **1.1Molecular Symmetry (6L)** | |
| 1.1.1 Introduction and Importance of Symmetry in Chemistry. | |
| 1.1.2 Symmetry elements and Symmetry operations. | |
| 1.1.3 Concept of a Point Group with illustrations using the following point groups :(i)$C_{\infty V}$ (ii) $D_{\infty h}$ (iii) $C_{2V}$ (iv) $C_{3v}$ (v)$C_{2h}$ and (vi)$D_{3h}$ | |
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| **1.2 Molecular Orbital Theory for heteronuclear diatomic molecules and polyatomic species (9L)** | |
| 1.2.1 Comparision between homonuclear and heteronuclear diatomic molecules. | |
| 1.2.2. Heteronuclear diatomic molecules like CO, NO and HCl, appreciation of modified MO diagram for CO. | |
| 1.2.3 Molecular orbital theory for $H_3$ and $H_3^+$ (correlation | |

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| diagram expected). | |
| 1.2.4. Molecular shape to molecular orbital approach in $AB_2$ molecules. Application of symmetry concepts for linear and angular species considering σ- bonding only. (Examples like : (i) $BeH_2$, (ii) $H_2O$). | |
| **UNIT-II** | |
| **2.0 CHEMISTRY OF INNER TRANSITION ELEMENTS (15L)** | |
| **2.1 Introduction:** , Position in periodic table and electronic configuration of lanthanides and actinides. | |
| **2.2 Chemistry of Lanthanides with reference to** (i) lanthanide contraction and its consequences(ii) Oxidation states (iii) ability to form complexes (iv) magnetic and spectral properties | |
| **2.3 :**Occurrence, extraction and separation of lanthanides by (i) Ion Exchange method and (ii) Solvent extraction method (Principles and technique) | |
| **2.4** Applications of lanthanides | |

## References

**SEM-V**

**Unit-I**


1. Per Jensen and Philip R. Bunker , Fundamentals of Molecular Symmetry , Series in Chemical Physics, Taylor & Francis Group
2. J. S. Ogden, Introduction to Molecular Symmetry, Oxford University Press
3. Derek W. Smith, Molecular orbital theory in inorganic chemistry Publisher: Cambridge University Press
4. C. J. Ballhausen, Carl Johan Ballhausen, Harry B. Gray Molecular Orbital Theory: An Introductory Lecture Note and Reprint Volume Frontiers in chemistry Publisher W.A. Benjamin, 1965
5. Jack Barrett and Mounir A Malati, Fundamentals of Inorganic Chemistry, Affiliated East west Press Pvt. Ltd., New Delhi.
6. Satya Prakash, G.D.Tuli, R.D. Madan , , Advanced Inorganic Chemistry.S. Chand & Co Ltd

**Unit-II**


1. Cotton, Wilkinson, Murillo and Bochmann, Advanced Inorganic Chemistry, 6th Edition.
2. Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth Heinemann. 1997.
3. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
4. G. Singh, Chemistry of Lanthanides and Actinides, Discovery Publishing House
5. Simon Cotton , Lanthanide and Actinide Chemistry Publisher: Wiley-Blackwell


## Practicals

### SEMESTER V

### INORGANIC CHEMISTRY

**COURSE CODE: USCHP07** **CREDITS: 01**

## I. Inorganic preparations

1. Preparation of Potassium diaquobis- (oxalato)cuprate (II)

## II. Determination of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests).

(Any two salts of transition metal ions)

**Reference Books (practicals)**


1. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.
2. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U.N.Dhur & Sons Pvt Ltd .
3. Vogel's. Textbook of. Macro and Semimicro *qualitative* inorganic *analysis*. Fifth edition.

**SEMESTER VI**

**INORGANIC CHEMISTRY**

**COURSE CODE: USCH602** **CREDITS: 01** **LECTURES: 30**

| **UNIT-I** | **L/week** |
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| **1.Theories of the metal-ligand bond (I) (15L)** | |
| 1.1 Limitations of Valence Bond Theory. | |
| 1.2 Crystal Field Theory and effect of crystal field on central metal valence orbitals in various geometries from linear to octahedral(from coordination number 2 to coordination number 6) | |
| 1.3 Splitting of *d* orbitals in octahedral, square planar and tetrahedral crystal fields. | |
| 1.4 Distortions from the octahedral geometry : (i) effect of ligand field and (ii) Jahn-Teller distortions. | |
| 1.5 Crystal field splitting parameters $\Delta$ ; its calculation and factors affecting it in octahedral complexes, Spectrochemical series. | |
| 1.6 Crystal field stabilization energy(CFSE), calculation of CFSE for octahedral complexes with $d^0$ to $d^{10}$ metal ion configurations. | |
| 1.7 Consequences of crystal field splitting on various properties such as ionic radii, hydration energy and enthalpies of formation of metal complexes of the first transition series. | |
| 1.8 Limitations of CFT : Evidences for covalence in metal complexes (i) intensities of d-d transitions, (ii) ESR spectrum of $[IrCl_6]^{2-}$ (iii) Nephelauxetic effect. | |

| UNIT-II | |
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| **2 SOME SELECTED TOPICS (15L)** | |
| **2.1 Metallurgy (7L)** | |
| 2.1.1 Types of metallurgies, | |
| 2.1.2 General steps of metallurgy; Concentration of ore, calcinations, roasting,reduction and refining. | |
| 2.1.3Metallurgy of copper: occurrence, Physicochemical principles , Extraction of copper from pyrites& refining by electrolysis. | |
| **2.2 Chemistry of Group 18 (5L)** | |
| 2.2.1 Historical perspectives | |
| 2.2.2 General characteristics and trends in physical and chemical properties | |
| 2.2.3 Isolation of noble gases | |
| 2.2.4 Compounds of Xenon (oxides and fluorides) with respect to preparation and structure (VSEPR) | |
| 2.2.5 Uses of noble gases | |
| **2.3 Introduction to Bioinorganic Chemistry. (3L)** | |
| 2.3.1Essential and non essential elements in biological systems. | |
| 2.3.2 Biological importance of metal ions such as $Na^{+}$,$K^{+}$,$Fe^{+2}$/$Fe^{+3}$ and $Cu^{+2}$(Role of $Na^{+}$ and $K^{+}$w.r.t. ion pump.) | |
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**REFERENCES:**

**SEM VI**

**Unit-I**

1. Geoffrey A. Lawrance Introduction to Coordination Chemistry John Wiley & Sons.
2. R. K. Sharma Text Book of Coordination Chemistry Discovery Publishing House
3. R. Gopalan , V. Ramalingam Concise Coordination Chemistry , Vikas Publishing House;
4. Shukla P R, Advance Coordination Chemistry , Himalaya Publishing House
5. Glen E. Rodgers, Descriptive Inorganic, Coordination, and Solid-State Chemistry Publisher: Thomson Brooks/Cole

**Unit-II**

1 R. Gopalan, Inorganic Chemistry for Undergraduates, Universities Press India.
2 D. F. Shriver and P. W. Atkins, Inorganic chemistry, 3rd edition, Oxford University Press
3 Cotton, Wilkinson, Murillo and Bochmann, Advanced Inorganic Chemistry, 6th Edition.
4 Jack Barrett and Mounir A Malati, Fundamentals of Inorganic Chemistry, Affiliated East west Press Pvt. Ltd., New Delhi.
5 R.Gopalan, Chemistry for undergraduates. Chapter 18. Principles of Metallurgy.(567-591)
6 Puri ,Sharma Kalia Inorganic chemistry. Chapter 10, Metals and metallurgy.(328-339)
7 Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth Heinemann. 1997.
8 Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
9 Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
10 Satya Prakash, G.D.Tuli, R.D. Madan , , Advanced Inorganic Chemistry.S. Chand & Co Ltd

## Practicals

**SEMESTER V**

**INORGANIC CHEMISTRY**

**COURSE CODE: USCHP08** **CREDITS: 01**

**I. Inorganic preparations**

Preparation of Tris(acetylacetonato) iron(III)

**II. Determination of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests).**

(Any three salts of main group metal ions)

**Reference Books (practicals)**


4. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.
5. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U.N.Dhur & Sons Pvt Ltd .
6. Vogel's. Textbook of. Macro and Semimicro *qualitative* inorganic *analysis*. Fifth edition.