ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 4Hrs/Week

Code CH 7201(3)

Revised Syllabus Under CBCS 2020-21 Marks: 100

Inorganic Chemistry-I:

Advanced Studies in Complexes and Group Theory

Course Objectives: To enable students to understand and apply

- different theories pertaining to bonding and stability of complex compounds along with
- Group theoretical principles to establish the 3D geometries and point groups of different molecules.

Course Outcomes:

- The student will understand the VSPER theory, symmetric and unsymmetric Hydrogen bonds in inorganic molecules.
- Understanding the Crystal field theory and Jahn Teller Effects.
- The students will be able to understand the basics of molecular orbital theory and energetic of hybridization.
- The students are able to understand the Jobs method, hard and soft acids and bases.
- The students will acquire the knowledge of symmetry

II. Syllabus

Unit-I: Chemistry of non- transition elements: 12Hours

Inter halogen compounds, Halogen oxides and oxyfluorides, Clathrate compounds, Spectral and Magnetic properties of Lanthanides and Actinides. Analytical applications of Lanthanides and Actinides. Synthesis, properties and structure of B-N, S-N,P-N cyclic compounds. Intercalation compounds.

Metal π- complexes: preparation, structure and bonding in Nitrosyl, Dinitrogen and Dioxygen complexes.

Unit-II: Structure and Bonding: 12Hours

pπ-dπ bonding, Bent's rule, Non-valence cohesive forces, VSEPR theory. Molecular Orbital theory, Symmetry of Molecular orbitals, Molecular orbitals in triatomic (BeH_2) molecules and ions (NO_2^-) and energy level diagrams. Application of MO theory to square planar

($PtCl_4^{2-}$) and octahedral complexes (CoF_6^{3-} ,$Co(NH_3)_6^{3+}$).Walsh diagrams for linear (BeH_2) and bent(H_2O)molecules.

Unit-III: Metal–ligand bonding: 12Hours

Crystal Field Theory of bonding in transition metal complexes-Splitting of d-orbitals in octahedral, tetrahedral, square planar and Trigonal bipyramidal and Square pyramidal fields. Tetragonal distortions - Jahn-Teller effect. Applications and limitations of CFT. Experimental evidences for covalence in complexes. Molecular Orbital Theory of bonding for Octahedral, tetrahedral and square planar complexes. π-bonding and MOT - Effect of π - donor andπ – acceptor ligands on Δo. Experimental evidence for π-bonding in complexes.

Unit-IV: Metal–ligand Equilibriain solutions: 12Hours

Step wise and overall formation constants. Trends in stepwise constants (statistical effectand statistical ratio). Determination of formation constantsby Spectrophotometric method (Job's method) and Ph metric method (Bjerrum's). Stability correlations -Irwing-William's series. Hard and soft acids and bases (HSAB), Acid-base strengths.

Unit- V: Group theory 12Hours

Basic concepts of Symmetry and Group theory – Symmetry elements, Symmetryoperations and point groups – Schoen flies symbols –Classification ofmolecules into point groups– Axioms of Group theory– Groupmultiplication tables for C_{2V} andC_{3V} point groups – SimilarityTransformationand classes –Representations – reducible and irreduciblerepresentations, Mulliken symbols,Orthogonality theorem and its implications,character table and its anatomy.

III. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.
3. Visits of abilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/ industrial experts.

Text books:

1. Inorganic Chemistry Huheey, Harper and Row.
2. Physical methods in inorganic chemistry, R.S.Drago. Affliated East-West Pvt. Ltd.
3. Concise inorganic chemistry, J.D. Lee, ELBS.
4. Modern Inorganic Chemistry, W.L. Jolly, Mc Graw Hill.
5. Inorganic Chemistry, K.F. Purcelland J.C .Kotz Holt Saunders international.
6. Concepts and methods of inorganic chemistry, B.E. Douglas and D.H.M.C. Daniel, oxford Press.
7. Introductory quantum Mechanics, A.K. Chandra.
8. Quantum Chemistry, R.K. Prasad.

Reference books:

1. In organic Chemistry, Atkins, ELBS**.**
2. Advanced Inorganic Chemistry, Cotton and Wilkinson, Wiley Eastern**.**
3. Text book of Coordination chemistry, K. Soma Sekhara Rao and K.N.K. Vani, Kalyani Publishers.
4. Group Theory and its Applications to Chemistry, K.V. Raman, Tata Mc Graw– Hill Publishing Company Ltd. New Delhi.
5. Chemical Applications of Group Theory, F.A. Cotton Wiley Eastern Limited New Delhi.

Note: A minimum of 4 inorganic mixtures must be analysed in this Semester.

III. Co-Curricular Activities

Mandatory: (Lab/fieldtrainingofstudentsby teacher (lab:10+field:05):

1. **For Teacher**: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of involves identification and conformation of cationsand anions containing one less familiar cation and one interfering anion.
2. **For Students**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Field work/projectworkReport:05.
4. Suggested Format for Fieldwork/project work**:** Title page, student details,index page, details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

IV. Reference Books:

1. Practical Inorganic Chemistry, G. Marrand B. W. Rockett.
2. Practical Inorganic Chemistry by G.PassH.Sutchiffe, 2nd ednJohnWiley&Sons.
3. Experimental Inorganic/Physical Chemistry, M.A.Malati, Horwood Publishing,Chichester, UK(1999)
4. Vogel's textbook of semi micro qualitative analysis, 5th Edition by G. Svehla.

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VII SEMESTER **B.Sc HONOURS CHEMISTRY** Time: 3Hrs

Code **Revised Syllabus under CBCS 2020-21** Max. Marks: 60M

Domain Subject: CHEMISTRY

Course: 8A: INORGANIC CHEMSTRY

ADVANCE STUDIES IN COMPLEXES AND GROUP THEORY

Section –A

I. Answer any Three of the Following: 3 X 10 = 30M

1. Explain preparation, properties and structure of S-N compounds
2. Write postulates of Molecular orbital theory and its application to $PtCl_4^{2-}$.
3. Explain Jahn-Teller Effect. Write the applications of Crystal Field Theory.
4. Describe orthogonality theorem and its implications.
5. Determine the formation constant by Spectro-photometric Method and pH metric method.

Section-B

II. Answer any Four of the Following: 4 X 5 = 20 M

1. Explain the spectral and magnetic properties of lanthanides and actinides.
2. raw the walsch's diagram for linear BeH_2.
3. Explain plane of symmetry and axis of symmetry.
4. Write a short note on step-wise and overall formation constant.
5. Write differences between crystal field splitting in octahedral and tetrahedral complexes.
6. Describe the properties and applications intercalation compounds.

Section-C

III. **Answer any Five of the Following: 5 X 2 = 10 M**

1. State Bent rule
2. Draw the structure of Diborane and write its molecular formula.
3. Write two differences between actinides and lanthanides.
4. State law of rationality of indices
5. Arrange the given ions Mn(II), Fe(II), Co(II), Ni(II), Cu(II) and Zn(II) according to the Irving William order of stability.
6. Write the point group for NH_3 and H_2O.
7. Calculate the CFSE for d6 in octahedral and tetrahedral complex
8. Write two differences between a Hard acid and a Soft acid.