CHE-363-MJP: INORGANIC CHEMISTRY PRACTICAL-II

Course Type: Major Elective Practical **Credits: 2**

A. Course Objectives:

1. To develop practical skills in quantitative inorganic analysis using volumetric and instrumental methods.
2. To train students in the operation and application of analytical instruments such as flame photometer and spectrophotometer.
3. To provide hands-on experience in separation and purification techniques including chromatography and ion-exchange methods.
4. To familiarize students with synthesis, characterization, and applications of inorganic nanomaterials and coordination compounds.
5. To enhance understanding of periodic trends, complex formation, and catalytic reactions through laboratory experiments.
6. To inculcate laboratory safety practices, scientific observation, data interpretation, and report writing skills in inorganic chemistry practicals.

B. Course Outcomes (COs):

CO No.	Course Outcome Statement (COs) *After learning the course, the students are able to -*
CO-1	Recall the principles, reactions, safety procedures, and analytical methods used in inorganic chemistry practicals.
CO-2	Explain the concepts of volumetric analysis, flame photometry, spectrophotometry, chromatography, and nanomaterial synthesis.
CO-3	Apply quantitative and instrumental analytical techniques for estimation, separation, purification, and synthesis experiments.
CO-4	Analyze experimental observations, spectral data, chromatographic separations, and periodic trends in inorganic systems.
CO-5	Evaluate the accuracy, precision, efficiency, and environmental significance of different inorganic experimental methods and reactions.
CO-6	Design and perform inorganic chemistry experiments involving nanomaterial synthesis, complex formation, and analytical determinations using suitable methodologies.

C. Contents:

Prerequisites
Students should have basic knowledge of inorganic chemistry, chemical reactions, and stoichiometry. Familiarity with laboratory practices, handling of glassware, and safety procedures is required.
A minimum of 12 experiments are to be completed.
A. Volumetric Estimations (Any 3) 1. Analysis of Talcum powder [Ref-9] 2. Estimation of Zinc and Magnesium in the given mixture solution. [Ref-10] 3. Analysis of Phosphate (PO_4^{3-}) from Fertilizer. [Ref-1] 4. Analysis of Iodine from Iodized salt. [Ref-2] 5. Analysis of Calcium from milk powder. [Ref-1] 6. Analysis of Cu from Cu-Fungicide. [Ref-1]
B.a) Flame Photometry (Any 3) [Ref-1] 1. Estimation of Na by flame photometry by calibration curve method. 2. Estimation of Na by flame photometry by regression method. 3. Estimation of K by flame photometry by calibration curve method. 4. Estimation of K by flame photometry by regression method.
b)Spectrophotometry: Estimation of cola drinks by molybdenum blue method using spectrophotometry. [Ref-2]
C. Column Chromatography (Compulsory) [Ref-1] 1. Purification of water using cation/anion exchange resin and analysis by qualitative analysis /Conductometry.
D. Separation of Ni(III), Co(II) and Zn(II) ions using paper chromatography method**.** [Ref-10]
E. Nanomaterial synthesis (Any 1) [Ref-3, 4] 1. Synthesis of Silver nanoparticles. 2. Green synthesis and characterization of aluminium oxide nanoparticle using *Neem* leaf extract. [Ref-7] 3. Synthesis of ZnO nanoparticles. 4. Green synthesis of Cu nanoparticles using *Neem* leafextract. [Ref-8]
E. Verification of periodic trends using solubility of alkaline earth metal hydroxides: Ca(OH)2,

$Mg(OH)_2$, $Cr(OH)_2$ and $Ba(OH)_2$. [Ref-1]

F. Synthesis of amine complexes of Ni(II) and its ligand exchange reaction (bidentate ligands like acac, DMG, Glycine) by substitution method.

OR

F. Determination of the Metal to ligand ratio (M : L) in complexes. [Ref-5]

G. Solvent free microwave assisted one pot synthesis of Phthalocyanin copper (II) complex.

OR

G. Fenton reaction: Degradation of H2O2 using Fe catalyst. [Ref-6]

H. Table work: Calculation Band gap for TiO_2/ SnO_2/ ZnO nanoparticles from electronic Spectra (UVVisible). [Ref-3, 4]

References:

1. Vogel's textbook of Inorganic Quantitative Analysis, Jeffery, Basset, Mendham Deney, 5th Ed, Longman Scientific Technical, USA (co-published with John Wiley Sons).
2. General Chemistry Experiment – Anil J Elias (University press).
3. Nanotechnology: Principles and Practices by Dr.Sulbha Kulkarni. Third Edition,Springer.
4. A laboratory course in nanoscience and nanotechnology, Dr. Gerrad Eddy Jai Poinem, CRC press.
5. Experimental Inorganic Chemistry, Mounir A. Malati, Horwood Series in Chemical Science (Horword Publishing, Chichester) 1999.
6. Environmental Chemistry Microscale Laboratory Experiments, Jorge G.Ibanez Margarita Hemandez-Esparza Carmen Doria-Serrano Arturo Fregoso-Infante, Springer.
7. Green synthesis and characterization of aluminum oxide nanoparticle using neem leaf extract (Azadirachta Indica), Imosobomeh L. Ikhioya a a, Agnes C. Nkele, Hybrid Advances 5 (2024) 100141.
8. Green synthesis of copper nanoparticles using neem (azadirachta indica) leaf extract and their antimicrobial activity, D. Gurudevi, Ch.Sirisha, Dogo Rangsang Research Journal, Vol-13, Issue-2, No. 1, February 2023, ISSN : 2347-7180.
9. Experimental Chemistry- D. V. Jahagirdar, Himalaya Publishing House.
10. Advanced Practical Chemistry, Jagdamba Singh, R.K.P. Singh, Jaya Singh, LDS Yadav, IR Siddiqui, Jaya Shrivastav, Pragati Edition.