COURSE DETAILS:

Course Title	**Inorganic Chemistry-III**
Semester	**Semester-3**
Course Code	**CC-A7**
Course ID	
Total Credits	**04 (Lecture: 03, Tutorial: 0, Practical: 01)**
Total Marks	**100**
Marks Distribution	**Theory External: 50** **Theory Internal: 25** **Practical External: 20** **Practical Internal: 05**

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 5	
Lectures (L) Hours per Week: 3	**Practical (P) Hours per Week: 2**

COURSE OBJECTIVES

- To study the physical properties, chemical reactions, and applications of non-aqueous solvents.
- To explore the chemistry of boron and carbon families, including their structures, properties, and reactivity.
- To understand the electronic configuration, periodic properties, and oxides/oxyacids of nitrogen family elements.
- To introduce bioinorganic chemistry, focusing on trace metals, toxicity, and the biological role of essential metal ions.
- To develop analytical skills in gravimetric estimation of metal ions.
- To synthesize and characterize inorganic coordination complexes in the laboratory.

COURSE OUTCOMES

After completing this course, students will be able to

- Analyze the physical properties, self-ionization, and chemical reactions of non-aqueous solvents like NH_3, H_2SO_4, and SO_2.
- Explain the chemistry of the boron family, including diborane's electron-deficient bonding, borazine's structure, and Lewis acidity of boron trihalides.
- Describe the catenation, allotropes of carbon (diamond, graphite, fullerenes), and the structure of silicates and silicones.
- Compare the structure and acidic strength of oxides and oxyacids of nitrogen and phosphorus and explain allotropes of phosphorus.
- Evaluate the biological role and toxicity of essential and trace elements, including the structure-function relationship of metalloporphyrins like hemoglobin.

- Perform gravimetric analysis and prepare coordination complexes demonstrating experimental precision and analytical reasoning.

DETAILED CONTENT OF COURSE:

Theory & Practical Syllabus:

Total Contact Hours: 45 (Theory) + 30 (Practical)

Unit	Topics	Contact Hours
I	**Non-aqueous solvents** Physical properties of solvents, Properties and uses of non-aqueous solvents, Self ionization, physical properties and chemical reactions in non-aqueous solvents (liquid NH_3, liquid H_2SO_4, liquid SO_2, liquid BrF_5).	11
II	**Chemistry of Boron family** Boron family (13th group): Electronic configuration, periodic properties, inert pair effect and diagonal relationship. Diborane: Preparation, properties and structure (as an example of electron-deficient compound and multicenter bonding), Borazine chemical properties and structure, relative strength of trihalide of Boron as Lewis acids, the structure of aluminium (III) chloride.	11
III	**Chemistry of Carbon family** Electronic configuration and periodic properties, Catenation and allotropes of carbon (diamond, graphite and fullerenes), Carbides, structural aspects of silicates and silicones, preparation, properties and uses. **Chemistry of Nitrogen family** Electronic configuration and periodic properties, allotropes of phosphorus (white, red and black P), Oxides: Structure of oxides of nitrogen and phosphorus, Oxyacids: Structure and relative acidic strength of oxy acids of nitrogen and phosphorus.	12
IV	**Bioinorganic Chemistry** Essentials and trace elements present in biological systems, Excess and deficiency of some trace metals (Fe, Cu and Zn). Toxicity of metal ions (Hg, Pb, Cd and As), Use of chelating agents in medicine, platinum metal complexes as anticancer agents and their probable mechanism, Biological role of Na^+, K^+, Ca^{+2}, Mg^{+2}, Fe^{+2} ions. Metalloporphyrins with special reference to hemoglobin and myoglobin. Cooperative effect, Bohr effect; photosynthesis, nitrogen fixation.	11
V	Practical Gravimetric Analysis: 1. Estimation of nickel (II) using Dimethylglyoxime (DMG). 2. Estimation of copper as CuSCN 3. Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$. 4. Estimation of Al (III) by precipitating with oxine and weighing as $Al(oxine)_3$ (aluminiumoxinate). Inorganic Preparations: 1. Tetraamminecopper (II) sulphate, $[Cu(NH_3)_4]SO_4.H_2O$	30

	2. Cis and trans $K[Cr(C_2O_4)_2.(H_2O)_2]$ Potassium dioxalatodiaquachromate (III) 3. Tetraamminecarbonatocobalt (III) ion 4. Potassium tris(oxalate)ferrate(III)	

COURSE EVALUATION METHODS

Theory Exams: Total Marks: 75 (External: 50 + Internal: 25)

Internal Assessment: 25 Marks	• Class Participation: 05 Marks • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 15 Marks
External Assessment: 50 Marks (02 Hours)	• End Term Exam: 50 Marks

Practical Exam: Total Marks: 25 (External: 20 + Internal: 05)

Internal Assessment: 05 Marks	• Class Participation: 05 Marks
External Assessment: 20 Marks (02 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End-Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting of short answer type questions covering all the units of the syllabus. All questions should carry equal marks. Log table and non-programmable calculator is allowed.

SUGGESTED BOOKS

1. "Non-Aqueous Solvents" by J.J. Lagowski
2. "Inorganic Chemistry: Principles of Structure and Reactivity" by James E. Huheey, Ellen A. Keiter, and Richard L. Keiter
3. "Inorganic Chemistry" by Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr
4. "Concise Inorganic Chemistry" by J.D. Lee
5. "Inorganic Chemistry" by Catherine Housecroft and Alan G. Sharpe
6. "Bioinorganic Chemistry" by Ajai Kumar
7. "Quantitative Inorganic Analysis" by A. I. Vogel
8. "Advanced Practical Inorganic Chemistry" by R.D. Madan
9. "Experimental Inorganic Chemistry" by A.K. Srivastava and C.P. Sharma