

**FIRST SEMESTER 2023-24**  
**Course Handout (PART II)**

11/08/2023

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

**Course No.** : **CHEMF214**  
**Course Title:** **Inorganic Chemistry I**  
**Instructor-in-charge** : **Prof.N.Rajesh**  
**Instructor-(Lec and Tut):** **Prof.N.Rajesh**

1. **Course Description:** This course primarily is intended to give a basic foundation to the various aspects of inorganic chemistry such as periodicity, bonding, structures of simple compounds and chemistry of some main group elements.
2. **Broad Learning outcomes:** The objective of this course is to provide a comprehensive survey in the topics detailed in the course plan with the following broad outcomes: -
  - Interpret the relevance of electronegativity and other periodic properties
  - Illustrate the importance of acid base chemistry and applications of Hard-soft acid base concept
  - Discuss the chemistry of halogens, noble gases and their significance
  - Outline the basic aspects of Solid state chemistry with real-world applications.
  - Explore the basic features of silicon and phosphorous chemistry
  - Recognize the importance of intercalation compounds (graphite, clays) inorganic chains, rings, cages and cluster compounds
3. **Text Book:** Huheey J. E., Keiter, Ellen A., Keiter, Richard L. Okhil K.Medhi, “**Inorganic Chemistry**”, 4<sup>th</sup> ed., Pearson Education 2006.

**Reference Books:** I. Inorganic Chemistry by **Shriver & Atkins, (4th edition), Oxford** . II. Cotton F.A., Wilkinson G., Murillo, C.A., Bochmann, M. “**Advanced Inorganic Chemistry**”, 6<sup>th</sup> ed., John Wiley and Sons, New York (2003).

**4. Course Plan:**

<i>Lec No</i>	<i>Topics</i>	<i>Learning Outcome</i>	<i>Learning Objectives</i>	<i>Ref. to text</i>
	<b>Concepts</b>			
1	Introduction	Relevance of inorganic chemistry In real life applications	Basic course description and discussion of handout	Lec discussion
2-5	Electronegativity	Applications and relevance in understanding inorganic concepts	Definition, scales of electronegativity <b>with</b>	Chapter 5

		like acidity, color, spectroscopy etc..	<b>experimental demo using AFM on determination of single atom electronegativity</b>	
6-8	Acid base chemistry	Relevance to environmental applications	Measures of acid base strength, Systematic acid base interactions, Hard soft acid base(HSAB) concept- <b>with experimental demo on extraction of metal ion using the above concept</b> diverse metal-ligand interactions, symbiosis and other applications	Chapter 8
9-11	Solvents and molten salts	Relevance in metallurgy	Chemistry of aqueous and non-aqueous solvents, molten salts (ionic liquids)	Chapter 9
12	Electrode potentials	Application to hydrometallurgy	Latimer diagram to calculate EMF and Frost diagram to predict the stability of oxidation states	Chapter 9
<b>Halogens/ Noble gases</b>				
13-15	Noble gas chemistry	Importance and applications	Early discovery of noble gases, isolation, xenon compounds, bond strength in noble gases	Chapter 12
16-18	Chemistry of halogens	Applications, synthetic aspects	Anomalous behavior of fluorine, Halogens oxides, oxy fluorides, interhalogens, polyhalides, oxy acids of halogens, halogen cations and pseudohalides	Chapter 12
<b>Bonding in Solids</b>				
19	VSEPR theory	Understand bonding	VSEPR rules (self study) applications to simple compounds, atomic inversion and pseudorotation	Chapter 6
20-22	Structures of crystal lattices	Importance of Solids in diverse applications	Lattice energy, structures of NaCl, CsCl, TiO <sub>2</sub> , CaF <sub>2</sub> , ZnS, Radius ratio rules, Fajans rules-covalent character	Chapter 4
23-24	Complex solids	Significance in world of materials	Layered structures, spinels and superconductors.	Chapter 4

			Basic aspects of band theory and crystal defects	
	<b>Main group elements-I</b>			
25-26	Main group elements: Periodicity	Implications of main group element properties in varied applications	First and second row anomalies, diagonal relationships, bonding in silicon and phosphorous compounds, Group IIIA, IVA anomalies, inert pair, relativistic effects and aurophilicity	Chapter 10
	<b>Main group elements-II</b>			
27-30	Inorganic chains	Importance of chain compounds in catalysis and analytical applications	Catenation, heterocatenation, silicate minerals, intercalation chemistry, one dimensional conductors, isopoly and heteropolyanions	Chapter 11 and chapter 13 (for iso and hetro polyanions)
31-34	Inorganic rings	Diverse properties and practical applications	Borazines, phosphazenes, phosphazene polymers, few heterocyclic and homocyclic ring systems	Chapter 11
35-37	Inorganic cages	Relevance and utility in inorganic and organic chemistry	Boranes, carboranes, structure prediction for heteroboranes, organometallic clusters	Chapter 11
38-40	Inorganic clusters	Importance in interesting real world applications	Metal clusters, (di, tri and tetra and hexa nuclear clusters-bonding in Rhenium and Molybdenum compounds, Zintl ions, Chevrel phases and infinite metal chains	Chapter 13

## 5 Evaluation Scheme:

EC NO.	Evaluation Component	Duration	Weightage (%)	Date Time	Remarks
1	Mid sem Test	90 min.	35	10/10 - 2.00 - 3.30PM	Closed book
* 2.	Quiz I	15 min	10		Open
	Quiz II	15 min	10		Open
*3	Group Discussion	10	5		Open

	(GD)	min/group			
4.	Comprehensive. Exam.	180 min	40	11/12 FN	Closed book

**\*Quiz (written) dates** will be announced prior and it would be conducted tentatively in the **last week of Sept and Oct. GD (research article based)** is like an open book component since each group is permitted to refer the journal articles with them during discussion. **GD would be held tentatively 10 days before the end of the semester.** Students would be divided into 5-6 members per group with duration of about 5-7 min per group. Topics and formation of group is left to the students' choice (representative topics could be suggested by instructor). **Evaluation for each member would be done based on the level of participation, ability to moderate in the right direction and knowledge of the particular topic assigned to each group.**

**6 Make-up Policy:** Make-up will be considered for only legitimate reasons with prior permission.

**7 Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**8 Chamber Consultation hours:** To be announced in the class.

**9. Notices:** Relevant notices regarding the course will be displayed on CMS.

Instructor in charge

ChemF214