

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: CHM241
2. Course Title: Basic Inorganic Chemistry-I
3. Per Week Lectures: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours [0-2]: 0 (A),
Credits (3*L+T+P+A): 9

Duration of Course: Full Semester

4. Proposing Department/IDP: Chemistry

Other Departments/IDPs which may be interested in the proposed course: Open to all, particularly CHE, BSBE, MSE, SEE

Other faculty members interested in teaching the proposed course: Faculty members of Inorganic Chemistry, CHM

Proposing Instructor(s): Faculty members of Inorganic Chemistry, CHM

5. Course Description:

A) Objectives: Fundamental concepts and principles of Inorganic Chemistry towards understanding chemical bonding theories, solid-state structures, redox reactions, and acid-base theories. Modern applications of inorganic chemistry in Biology, Health, Energy, and environment will be highlighted.

B) Contents (*preferably in the form of 5 to 10 broad titles*):

S. No	Broad Title	Topics	No. of Lectures
1.	Chemical bonding and Forces	Chemical bonding and various theories of covalency, types of bonding: ionic, covalent and metallic; valence bond theory, hybridization of atomic orbitals, molecular geometry and shape, fluxional behaviour of molecules, MO theory: Linear combination of atomic orbitals (LCAO), diatomic homonuclear species (O_2 , N_2), involvement of d-orbitals and CFT, bond energy, sigma (σ), pi (π), delta (δ) bonds, polarity, Fajan's rule, deformation of ions, Non-covalent interactions, supramolecules, hydrogen bonding.	10
2.	Solid State Structures	Born-Haber cycle, Lattice energy, crystal packing, radius ratio rules, Crystal systems and lattices, Structure of basic ionic crystals (AB, AB_2 , AB_3 , A_2B_3 types), X-ray diffraction and Bragg's law, crystal defects, band theory, perovskite and hybrid perovskite, superconductivity	6

3.	Oxidation-Reduction Reactions	Redox reactions, Nernst equation, oxidation-reduction potentials, formal potentials, equilibrium constants, over potentials, disproportionation and comproportionation reactions, Latimer and Frost diagrams, Electrochemical cells	6
4.	Acids and Bases	Acid-base concepts and principles (Arrhenius, Bronsted-Lowry, conjugate acids-bases, Lewis, HSAB), strength of acids and bases, acid-base equilibrium, indicator, Henderson equation, pH and buffer, non-aqueous solvents.	6
5.	Inorganic Chemistry in Biology, Health, Energy, and Environment	Inorganic elements in life related processes, oxygen carrying proteins, therapy and diagnosis, nitrogen fixation from air Inorganic elements in energy production and storage, hydrogen fuel cells, battery, Li-ion battery, sustainability.	12

C) Pre-requisites, if any (*examples: a- PSO201A, or b- PSO201A or equivalent*): CHM102, CHM103

D) Short summary for including in the Courses of Study Booklet:

Fundamental concepts and principles of Inorganic Chemistry, chemical bonding theories, solid-state structures, redox reactions and acid-base theories. Frontier applications of inorganic chemistry in biology, health, energy, and environment.

7. Recommended books:

Textbooks:

- [1] *Inorganic Chemistry-Principles of Structure and Reactivity*, 4thEdn., J. E. Huheey, E. A. Keiter and R. L. Keiter, Harper-Collins, NY, 1993
- [2] *Concepts and Models of Inorganic Chemistry*, 3rdEdn., B. Douglas, D. McDaniel and J. Alexander, John Wiley, New York. 1993
- [3] Shriver and Atkins *Inorganic Chemistry*, 5th Edn., Oxford University Press, 2009.

Reference Books:

- [4] *Chemistry of the Elements*, 2ndEdn., N. N. Greenwood and A. Earnshaw, Pergamon, Oxford, 2005
- [5] *Advanced Inorganic Chemistry*, 6th Edn., F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Wiley, 1999
- [6] *Principles Of Bioinorganic Chemistry*, I. Bertini & J. M. Berg, University Science Books, California
- [7] *Modern Inorganic Chemistry*. 2nd Edn. Jolly, W. L. McGraw-Hill, NY, 1991.
- [8] *Chemistry of High-Energy Materials*, T. M. Klapötke, 4th Edn., 2009

8. Any other remarks:

Dated: 11.03.2022 Proposer: Faculty members of Inorganic Chemistry, CHM

Dated: 11.03.2022 DUGC/DPGC-Convener: Dr. T. G. Gopakumar 

The course is approved / not approved

Chairman, SUGC/SPGC

Dated: _____