Course Code	Course Name	Credits
26CH510	ADVANCE INORGANIC CHEMISTRY	04

Course Objectives

- To understand acid–base theories, bonding concepts, and chemistry of main group elements.
- To explain the properties and applications of lanthanides, actinides, and solid-state structures.
- To analyze nuclear structure, radioactivity, and various nuclear processes and applications.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Understand acid–base theories including Arrhenius, Brønsted–Lowry, Lewis concepts, and HSAB principles.
- Explain the structure, bonding, and properties of main group compounds, clusters, and boranes.
- Analyze the chemistry of lanthanides and actinides, including their properties, separation, and applications.
- Evaluate solid-state structures and nuclear chemistry concepts including radioactivity, nuclear reactions, and reactors.

Unit 1 -Arrhenius acids and bases, Bronsted-Lowery concept (12 Hrs.)

Arrhenius Acids and Bases; Brønsted–Lowry Concept; Conjugate Acid–Base Pairs; Basicity of Anions from Hydrides of Non-Metals (Same Period and Groups VA, VIA, VIIA); Relative Order of Acidic Strength of Same Period Elements; Acidity of HX Molecules; Stability and Basicity of Oxyanions; Acidic Strength of Oxyacids (Same Group); Lewis Acids and Bases; Hard and Soft Acids and Bases (HSAB); Symbiosis; Applications of HSAB

Unit 2- Chemistry of some main group elements (12 Hrs.)

Boranes (Synthesis, Properties, Structure); Cages and Clusters; Wade's Rules; Styx Notation; Electron Count in Polyhedral Boranes; Carboranes; Borazines; Silicates; Carbides; Silicones; Phosphazenes; Peroxo Compounds of Boron, Carbon and Sulphur; Oxyacids of Nitrogen, Phosphorus, Sulphur and Halogens

Unit 3 - Chemistry of lanthanides and actinides (12 Hrs.)

Lanthanides (Oxidation States, Lanthanide Contraction, Separation Methods, Shift Reagents); Actinides (Electronic Configuration, Oxidation States, Sources, Extraction, Applications); Radioactivity of Actinides

Unit 4 – Introduction to solids-crystalline and amorphous (12 Hrs.)

Unit Cell; Bravais Lattices; Miller Indices and Plane Labelling; Symmetry Properties; Fundamentals of X-Ray Diffraction; Powder and Rotating Crystal Methods; Systematic Absences and Lattice Determination; Crystal Structures (Rock Salt, Cesium Chloride, Wurtzite, Zinc Blende, Rutile, Fluorite, Antifluorite, Diamond, Graphite, Spinel, Normal and Inverse Spinels, Perovskite)

Unit 5 - Nucleus (12 Hrs.)

Nuclear Structure; Stability of Nuclei; Packing Fraction; Even–Odd Nature of Nucleons; Neutron/Proton Ratio; Nuclear Potential; Binding Energy; Exchange Forces; Nuclear Models (Shell Model, Liquid Drop Model); Radioactive Decay Models; Detection of Radioactivity (Cloud Chamber, Nuclear Emulsion, Bubble Chamber, Geiger–Müller Counter, Scintillation Counter, Cherenkov Counter); Nuclear Reactions (Types, Cross Section, Q-Value, Threshold Energy, Compound Nucleus Theory, High Energy Reactions); Nuclear Fission and Fusion; Stellar Energy; Nuclear Reactors and Types; Radioanalytical Methods

Reference Books:

1. J.E. Huheey, E.A. Keiter and R.L. Keier, Harper and Row, Inorganic Chemistry, 4th Edn., 1993.
2. A.R. West, Basic solid state chemistry, 1991, John Wiley.
3. Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry, Volume- I, 2014, S. Chand and Company Pvt. Ltd, New Delhi.
4. S. Glasstone, Source Book on Atomic Energy, 1969, Van Nostrand Co.,
5. G. Frielander, J.w. Kennedy and J.M. Miller, Nuclear and Radiochemistry, 1981, John Wiley and Sons.
6. Hari Jeevan Arnikar, Essentials of nuclear chemistry, 2005, New Age International (P) Ltd.,
7. Hari Jeevan Arnikar,Nuclear Chemistry Through Problems, 2007, New Age International (P) Ltd.,
8. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 1988, John Wiley & Sons, 5th Edn.,

Websites and eLearning Sources:

1. https://www.youtube.com/watch?v=WfIP8t_F3PE
2. https://www.youtube.com/watch?v=ZNLOotK_UuA&list=PLOxj-7rZRao4uXQUVbOQSZX801JO2_BYt
3. https://www.youtube.com/watch?v=A9jI_oXnMMI&list=PLYXnZUqtB3K9ar-63At7_pGPvkBqRuOV-

COs and Bloom's Taxonomy Mapping – 26CH510		
Course Outcomes	**On completing P.G. program the students will be able to**	**BTL**
CO1	Apply Arrhenius and Brønsted-Lowry theories to explain acid-base behavior in various contexts.	K1, K2
CO2	Apply knowledge of main group chemistry to explore the synthesis, properties, and uses of its compounds.	K3
CO3	Analyze the properties and extraction of lanthanides and actinides by examining their oxidation states, contraction, shifts, and applications.	K4
CO4	Evaluate a sample's crystallinity by assessing its symmetry and interpreting X-ray diffraction data for accurate characterization.	K5
CO5	Design a working model for radioactive detection and energy generation by applying radioactive decay principles to support sustainable development.	K6

BTL K1 and K2 – remembering and understanding, K3- Applying, K4 – Analyse, K5- Evaluate and K6- Create

Relationship Matrix – 26CH510												
Course Outcomes	**Programme Outcomes (POs)**						**Programme Specific Outcomes (PSOs)**					**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	1	1	1	3	3	2	2	1	2.1
CO2	3	3	3	3	1	1	3	3	2	2	1	2.3
CO3	3	3	3	2	1	1	3	3	3	3	2	2.5
CO4	3	3	3	2	2	1	3	3	3	3	3	2.6
CO5	3	3	3	3	3	2	3	3	3	3	3	2.9
											Total	2.5

Mean Score: 3- High, 2- Medium/Moderate, 1-Low