



# ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

## CHEMISTRY: MINOR

w.e.f AY 2023-24

### Course structure

SEMESTER	Course Code	Title	Hr/ week	Credits
II	1	General & Inorganic Chemistry - (T)	3	3
		General & Inorganic Chemistry - (P)	2	1
III	2	Fundamentals in Organic Chemistry - (T)	3	3
		Fundamentals in Organic Chemistry - (P)	2	1
IV	3	Physical Chemistry-II (States of Matter, Phase Rule & surface Chemistry) - (T)	3	3
		Physical Chemistry-II (States of Matter, Phase Rule & surface Chemistry) - (P)	2	1
	4	General & Physical Chemistry - (T)	3	3
		General & Physical Chemistry - (P)	2	1
V	5 A	Analytical Methods in Chemistry-Quantitative analysis	3	3
		Analytical Methods in Chemistry-Quantitative analysis	2	1
		OR		
	5 B	Environmental Chemistry	3	3
		Environmental Chemistry	2	1
	6A	Chromatography and Instrumental methods of Analysis	3	3
		Chromatography and Instrumental methods of Analysis	2	1
		OR		
	6 B	Green Chemistry and Nanotechnology	3	3
		Green Chemistry and Nanotechnology	2	1

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11/9/23  
P. Gopal

**II - SEMESTER**  
**Course Code 1: GENERAL AND INORGANIC CHEMISTRY**  
**Credits: 03**

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**Course Outcomes:** At the end of the course the student will be able to-

1. Understand the structure of atom and the arrangement of elements in the periodic table.
2. Understand the nature and properties of ionic compounds.
3. Identify the structure of a given inorganic compound.
4. Explain the existence of special types of compounds through weak chemical forces.
5. Define acids and bases and predict the nature of salts.

**Syllabus:**

**Unit I: Atomic Structure and Periodic table (9 h)**

Electronic configuration: Bohr theory, dual nature of electrons, Heisenberg uncertainty principle, the Schrodinger equation, significance of wave functions, normalization of wave function, radial and angular wave functions, Pauli's exclusion principle, Hund's rule, sequence of energy levels (Aufbau principle).


Periodicity: periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number, horizontal, vertical, and diagonal relationships in the periodic table. 1.3 General properties of atoms: size of atoms and ions-atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity; electronegativity - Pauling, Mulliken-Jaffe, Allred-Rochow definitions; oxidation states and variable valency; isoelectronic relationship; inert-pair effect;

**UNIT 2: Ionic bond (9 h)**

Properties of ionic compounds, factors favouring the formation of ionic compounds-ionization potential, electron affinity, and electronegativity. Lattice energy: definition, factors affecting lattice energy, Born-Haber cycle-enthalpy of formation of ionic compound and stability. Stability of ionic compounds in terms of  $\Delta H_f$  and  $U_o$ . Solubility and thermal stability of ionic compounds. Covalent character in ionic compounds-polarization and Fajan's rules; effects of polarization-solubility, melting points, and thermal stability of typical ionic compounds.

**UNIT 3: The Covalent Bond (9 h)**

Valence Bond theory-arrangement of electrons in molecules, hybridization of atomic orbitals and geometry of molecules- $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ - VSEPR model-effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity,



isoelectronic principle, illustration of structures by VESPR model- $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{SF}_4$ ,  $\text{ICl}_4^-$ ,  $\text{ICl}_2^-$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$

Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules ( $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{CO}$  and  $\text{NO}$ )

#### UNIT 4: Metallic and Weak Bonds (9 h)

The Metallic bond: metallic properties, free electron theory, Valence Bond Theory, band theory of metals. Explanation of conductors, semiconductors and insulators.

Weak bonds: hydrogen bonding-intra- and intermolecular hydrogen bonding, influence on the physical properties of molecules, comparison of hydrogen bond strength and properties of hydrogen bonded N, O and F compounds; associated molecules-ethanol and acetic acid; Vanderwaals forces, ion dipole-dipole interactions.

#### UNIT 5: Acids and Bases (9 h)

Theories of acids and bases: Arrhenius theory, Bronsted-Lowry theory, Lewis theory, the solvent system, Nonaqueous solvents: classification-protonic and aprotic solvents, liquid ammonia as solvent-solutions of alkali and alkaline earth metals in ammonia.

Types of chemical reactions: acid-base, oxidation-reduction, calculation of oxidation number. Definition of pH,  $\text{pK}_a$ ,  $\text{pK}_b$ . Types of salts, Salt hydrolysis. Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

#### List of Reference Books:

1. J. D. Lee, Concise Inorganic Chemistry, 5<sup>th</sup> ed., Blackwell Science, London, 1996.
2. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., 1996.
3. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3<sup>rd</sup> ed., W. H. Freeman and Co, London,

### II - SEMESTER

#### Course Code 3: GENERAL AND INORGANIC CHEMISTRY

Credits: 01

#### Practical- I Qualitative Analysis of SIMPLE SALT

Qualitative inorganic analysis (Minimum of Six simple salts should be analysed) 50 M

##### I. Course outcomes:

At the end of the course, the student will be able to;

1. Understand the basic concepts of qualitative analysis of inorganic simple salt.
2. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory

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3. Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

## **II. Laboratory course syllabus:**

### **Analysis of SIMPLE SALT 50 M**

Analysis of simple salt containing ONE anion and ONE cation from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Magnesium and Ammonium.

### **Co-curricular activities and Assessment Methods**

1. Continuous Evaluation: Monitoring the progress of student's learning.
2. Class Tests, Work sheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. SEMESTER -End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the SEMESTER .

### **Reference books:**

1. Vogel's Qualitative Inorganic Analysis, Seventh edition, Pearson.

