PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
*Autonomous*
Siddhartha Nagar, Vijayawada–520010
*Re-accredited at 'A+' by the NAAC*

# 23CHMIL121: GENERAL AND INORGANIC CHEMISTRY

**Offered to: All UG Programs** **Course Type:** Minor 1 (Core -TH)

**Year of Introduction: 2023-24** **Year of offering: 2023 - 2024**

**Semester**: II 60 Hrs **Credits: 3**

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

| Course Outcome NO | Outcome | Mapping to |
|---|---|---|
| CO1 | Remember the structure of atom and the arrangement of elements in the periodic tabl | PO2 |
| CO2 | Understand the nature and properties of chemical bonds in general and inorganic chemistry | PO1 |
| CO3 | Applying the theories for the formation of inorganic compounds **in** general and inorganic chemistry. | PO2 |
| CO4 | Analyzing the existence of inorganic compounds in general and inorganic chemistry. | PO2 |
| CO5 | Create awareness on theories of acids, bases and predict the nature of salts in general and inorganic chemistry | PO2 |

| CO-PO MATRIX | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **CO-PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
| **23CHMIL121** | **CO1** | | H | | | | | |
| | **CO2** | M | | | | | | |
| | **CO3** | | L | | | | | |
| | **CO4** | | H | | | | | |
| | **CO5** | | H | | | | | |

**Syllabus:**

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

Electronic configuration: Bohr theory, duel 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; electro negativity - 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)**

Valance Bond theory-arrangement of electrons in molecules, hybridization of atomic orbitals and geometry of molecules-$BeCl_2$, $BF_3$, $CH_4$, $PCl_5$, $SF_6$– VSEPR model-effect of bonding and nonbonding electrons on the structure of molecules, effect of electro negativity, 4 isoelectronic principle, illustration of structures by VESPR model-NH3, H2O, SF4, $ICl-$ , 2 $ICl-$, XeF4, XeF6

Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules ($N_2$, $O_2$, CO and 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, $pK_a$, $pK_b$. Types of salts, Salt hydrolysis. Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard andSoft-Soft combinations.

**Text Book**

1.Genaral and inorganic chemistry by Roy.Mukherjee.Das

**List of Reference Books:**

1. J. D. Lee, Concise Inorganic Chemistry, 5th 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, 3rd ed., W. H. Freeman and Co, London,

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# 23CHMIL121: GENERAL AND INORGANIC CHEMISTRY

Minor - 1 Semester II

Time: 3 hours Maximum Marks: 70

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**Section - A** 5 X 4 = 20 Marks

**Answer the following questions. Each carries FOUR marks**

1. a) Describe Pauli's exclusion principle. **L1-CO1**

**Or**

b) Discuss inert-pair effect. . **L1-CO1**

2. a)Tell factors favouring the formation of ionic compounds. **LI -CO2**

**Or**

b) Describe Fajan's rules. **L1-CO2**

3. a)Explain about Valance Bond theory. **L2-CO3**

**Or**

b)Summarize Hybridization and structure of $BF_3$, $CH_4$ by using VBT . **L2-CO3**

4. a)Interpret free electron theory **L2-CO4**

**Or**

b) State ion dipole-dipole interactions. **L2-CO4**

5. a) Explain Bronsted-Lowry theory and Lewis theory of acid and base. **L2-CO5**

**Or**

b) Define pH, $pK_a$, $pK_b$ with an example each. **L2-CO5**

**Section-B** 5 X 10 = 50 Marks

**Answer the following questions. Each carries TEN marks**

6 (a). Explain Bohr theory and duel nature of electrons. **L2-CO1**

(or)

(b) Explain ionic radii, covalent radii, ionization potential, electron affinity; electro negativity**.** **L2CO1**

7 (a). Describe Born-Haber cycle. **L1-CO2**

(or)

(b). Define Lattice energy. Various factors affecting lattice energy. **L1-CO2**

8.(a). Explain VSEPR theory? Write vesper model structures of NH3, XeF4,XeF6 **L1-CO3**

(or)

(b). Construct the M.O. diagrams for $N_2$ and CO . **L1-CO3**

9.(a). Explain band theory of metals. **L2-CO4**

(or)

(b). Explain hydrogen bonding-intra- and intermolecular hydrogen bonding. **L2-CO4**

10.(a).Difine Nonaqueous solvents and write the classification of Nonaqueous solvents.**L2-CO5**

(or)

(b). Discuss Pearson's concept and explain HSAB principle & its importance. **L2-CO5**

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