Course Outline

Course Type	Course Code	Name of the Course	L	T	P	Credits
DC	NCYC101	**General Chemistry-I**	3	0	0	3

Course Objective
To familiarize students with different aspects of Chemistry as taught in an undergraduate course.
Learning Outcomes
Students will learn various perspectives of undergraduate chemistry.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Introductory Thermodynamics-I:** Concept of systems (open, closed and isolated) and surroundings. State of a system: Intensive and extensive variables. Partial derivatives. Exact and inexact differentials. Path function and State function. Concept of heat and work. Zeroth law of thermodynamics. Concept of thermodynamic reversibility. Concept of internal energy and 1st law of thermodynamics. Enthalpy and heat capacity, Relations between C_p and C_v. Isothermal and Adiabatic processes; Calculations of ΔU, ΔH, q and w involving ideal gases in different processes. Enthalpy of reaction. Hess's law. Enthalpy of formation and combustion. Kirchhoff's equation.	8	Understanding of thermodynamic parameters and their properties. Analyzing property diagrams to determine states of substances
2	**Introductory Chemical Kinetics-I:** Concept of order and molecularity. Rate laws for zero, 1st and 2nd order reactions and in general for any n-th order reaction. Determination of order of a reaction by half-life and differential methods. Rate determining step and steady state approximation. Opposing, Consecutive and parallel reactions (first-order steps only). Temperature dependence of rate constant and Arrhenius equation.	6	Students will learn about the activity of different types of chemical reactions. Basic understanding of rate laws and their implementation.
3	**Atomic structure:** Quantum numbers and their significance. Shapes of orbitals. Pauli's Exclusion Principle, Hund's rules and multiplicity, Exchange energy, Aufbau principle and its limitations. **Periodic Table and properties:** Modern IUPAC Periodic table, Effective nuclear charge, Slater's rules, ionic radii, Ionization potential, electron affinity and electronegativity. Group trends and periodic trends of these properties, relativistic Effect, inert pair effect, lanthanide contraction.	14	Students will get basic knowledge of atomic structure and periodic properties.
5	**Bonding and Physical Properties** ***Valence Bond Theory:*** Concept of hybridization, shapes of molecules, resonance (including hyperconjugation); calculation of formal charges and double bond equivalent (DBE); orbital pictures of bonding. ***Electronic Displacements:*** inductive effect, field effect, mesomeric effect, resonance energy; bond polarization and bond polarizability; electromeric effect; steric effect, steric inhibition of resonance.	6	Students will learn the basic concept of bond formation between carbon and other atoms. They will also learn about different electronic effects that control the structure and function of organic molecules.
6	***Molecular Orbital Theory:*** Qualitative idea about molecular orbitals, bonding and antibonding interactions. Acyclic and cyclic p orbital system; Hückel's rule, concept of aromaticity, antiaromaticity, homoaromaticity and non-aromaticity. ***Physical Properties of Organic Molecules:*** Influence of hybridization on bond energy; bond distances, bond angles; strain. Intra and intermolecular forces and their effect on	8	In this part, students will learn about the basic concepts of molecular orbitals and use those concepts to understand aromaticity. Then they will learn about the different types of molecular interactions that controls the physical

	physical properties of organic molecules. ***Concept of Organic Acids and Bases****:* Effect of structure, substituent and solvent on acidity and basicity; proton sponge; comparison between nucleophilicity and basicity; application of thermodynamic principles in acid-base equilibria.		properties of molecules. Finally, they will learn how the different electronic effects control the acidity and basicity of organic molecules.

Text Book:

1. **Levine, I. N. Physical Chemistry, 6th Edition, McGraw-Hill India, 2011.**
2. **Castellan, G. W. Physical Chemistry, Narosa, 2004.**
3. **Atkins, P. W. & Paula, J. de, Atkins' Physical Chemistry, 11th Edition, Oxford University Press, 2018.**
4. **Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson,2006**
5. **Cotton, F.A., Wilkinson, G., Murrillo, C. A., Bochmann, M., Advanced Inorganic Chemistry 6th Ed. 1999., Wiley**

Reference Books:

1. **Shriver Atkin's Inorganic Chemistry by P. Atkins, T. Overton, J. Rourke, M. Weller, M. Armstrong, 5th Edn, Oxford University Press, 2009.**
2. **Atkins, P. W. & Paula, J. de, Atkins' Physical Chemistry, 11th Edition, Oxford University Press, 2018.**