# Branch Specific Courses for Applied Chemistry Department

| Chemistry-I | | L | T | P | Credit |
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| CYCY 102 S1 | Scheme | 3 | 0 | 2 | 04 |

**ATOMIC STRUCTURE AND BONDING** **[12 Hours]**

De Broglie principle, postulates of quantum mechanics, Schrödinger wave equation: Derivation, significance of $\Psi^2$, Schrodinger wave equation for H-atom and particle in 1-D box, angular and radial wave function, Valence Band Theory, Valence Shell Electron Pair Repulsion theory, hybridization, geometry and shape of molecules, Molecular Orbital Theory, molecular orbital diagrams of diatomic and simple polyatomic molecules: $N_2$, $O_2$, $C_2$, $B_2$, $F_2$, CO, NO, and their ions; HCl, $BeF_2$, $CO_2$, (idea of s-p mixing and orbital interaction to be given), ionic solids, Born-Haber cycle, covalent bond, coordinate bond, hydrogen bond, dipole moment.

**THERMODYNAMICS** **[07 Hours]**

Scope and limitations of Thermodynamics, thermodynamic terms and basic concepts, first law of thermodynamics and its limitations, measurement of $\Delta E$, heat content or enthalpy, heat capacity, relation between Cp and Cv, temperature dependence of $\Delta H$, calculation of thermodynamic quantities.

**THE GASEOUS STATE** **[08 Hours]**

States of matter, general characteristics of gases, parameters of a gas, the gas laws, kinetic molecular theory of gases, derivation of kinetic gas equation and derivation of gas laws from it, deviations from ideal behavior and compressibility factor, effects of pressure and temperature on deviations and explanation for the deviations, van der Waals equation of state and its limitations, interpretation of deviations from van der Waals equation, liquefaction of gases-critical phenomenon, van der Waals equation and critical constants, methods of liquefaction of gases.

**CHEMICAL KINETICS** **[06 Hours]**

Rate of reactions, factors affecting reaction rates, molecularity of a reaction and order of reaction: zero, first, second and third, with their differential as well as integrated rate laws, characterization and examples, half-lives, methods of determination of order of reactions: integration, fractional change, graphical and isolation.

**ORGANIC COMPOUNDS AND REACTIONS** **[09 Hours]**

Structure and properties, relationship between shapes and properties of organic molecules: reactive intermediates, electrophiles and nucleophiles, free radical, carbonium ion and carbanion, carbenes, nitrenes, and arynes, types of organic reactions: stepwise, ionic and free radical mechanisms, single step concerted mechanism, addition, substitution, elimination and rearrangement, method of determining mechanisms (identification of product, isotope effects and determination of reaction intermediates).

**[Total Lecture Hours: 42]**

**LIST OF PRACTICALS**

1. Preparation of solution and its standardization (primary and secondary standards).
2. Titration (Acid-Base, Redox).
3. Purification of solid organic compounds using melting points.
4. Chemical kinetics (esterification/pseudo first/second order).

**RECOMMENDED/REFERENCE BOOKS:**


1. J. D. Lee, Concise Inorganic Chemistry, fourth edition ELBS, 1991.
2. P. Atkins, Paula J. D., Atkin's Physical Chemistry, Oxford (Indian Edition), Oxford University Press, 2012.
3. B. H. Mahan, University Chemistry, eighth edition, Narosa Publishing House, New Delhi, 1998.
4. R. P. Rastogi, R. R. Misra, An Introduction to Chemical Thermodynamcis, fourth edition, Vikas Publishing House Pvt. Ltd., New Delhi, India, 2000.
5. B. R. Puri, L. R. Sharma, Principles of Physical Chemistry, eighth edition, Vishal Publications, New Delhi, 2001.
6. M. B. Smith, Jerry March, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, sixth edition, Wiley-Interscience, 2012.
7. H. Maskill (Ed.), The Investigations of Organic Reactions and Their Mechanisms, first edition, Blackwell Publishing Ltd. Oxford, 2006.
8. A. I. Vogel, Elementary Practical Organic Chemistry: Qualitative Organic Analysis, second edition, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, South Asia, 1997.

| Chemistry-II | | L | T | P | Credit |
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| CYCY 113 S2 | Scheme | 3 | 0 | 2 | 04 |

- **THERMODYNAMICS** **(09 Hours)**
  Entropy and second law of thermodynamics, spontaneous thermodynamics processes, combined forms of the first and second laws of thermodynamics, criterion for distinguishing between irreversible and a reversible process, entropy changes for an ideal gas, entropy changes during phase changes, entropy changes in chemical reactions, physical significance of entropy, third law of thermodynamics and its conformation, applications and exceptions of third law of thermodynamics, free energy, thermodynamic functions and spontaneity, standard free energy of formation, free energy and equilibrium constants, temperature dependence of equilibria.

- **CATALYSIS** **(05 Hours)**
  Catalysis and its classification, characteristics of catalytic reactions, promoters and explanation of promotion action, catalytic poisoning and its explanation along with examples, autocatalysis and its examples, negative catalysis and its explanation with examples, activation energy and catalysis. Theories of catalysis: Intermediate compound formation theory and The adsorption theory, Acid-Base catalysis, Enzyme catalysis: examples, mechanism and characteristics.

- **PERIODIC PROPERTIES** **(08 Hours)**
  Long form of periodic table, effective nuclear charge, shielding, Slater rules, variation of effective nuclear charge in periodic table, atomic radii (van der Waals), ionic and crystal radii, covalent radii, ionization enthalpy and its applications, electron affinity, electronegativity, electronegativity scales. Variation of electronegativity with bond order, partial charge. Sanderson‟s electron density ratio. Introduction to s-block elements.

- **HYDROCARBONS** **(10 Hours)**
  Structure, preparation and reactions of: alkanes, alkenes and alkynes. Dienes: Nomenclature, classification, methods of formation of butadiene, chemical reactions, conjugated and isolated dienes, resonance stabilization, 1,2- versus 1,4- addition.

- **STEREOCHEMISTRY OF ORGANIC COMPOUNDS** **(10 Hours)**
  Conformations and configurations of alkanes; molecular chirality, enantiomers, diastereomers, threo- and erythro- diastereomers, meso compounds, resolution of enantiomers, retention and racemization. Relative and absolute configuration, sequence rules, D and L systems of nomenclature and R and S systems of nomenclature. Determination of composition of enantiomers and diastereomers. Geometric isomerism: determination of configuration of geometric isomers E and Z systems of nomenclature, geometric isomers of oximes and alicylic compounds.

**[Total Lecture Hours: 42]**

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**LIST OF PRACTICALS**

1. Inorganic Qualitative Analysis (Single salt).

**RECOMMENDED/REFERENCE BOOKS:**


1. B. H. Mahan, University Chemistry, eighth edition, Narosa Publishing House, New Delhi, India, 1998
2. S. Glasstone, Thermodynamics for Chemists, Affiliated East-West Press Pvt. Ltd., New Delhi, India. 2009.
3. B. S. Bahl, G. D. Tuli, A. Bahl, Essential of Physical Chemistry, fourth edition, S. Chand & Company Ltd, New Delhi, India, 2003.
4. J. D. Lee, Concise Inorganic Chemistry, fourth edition, ELBS, 1991.
5. B. E. Douglas, D. H. Mc Daniel, Concepts & Models of Inorganic Chemistry, Oxford, 1970. 6. M. C. Day, J. Selbin, Theoretical Inorganic Chemistry, second edition, ACS Publications, 1962.
6. E. L. Eliel, S. H. Wilen, Stereochemistry of Organic Compounds, first edition, WileyInterscience, 2008.
7. G. Svehla, Qualitative Inorganic Analysis, seventh edition, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, South Asia, 2009.