

**Unit-I****8L+4T**

**Atomic and molecular structure:** Schrodinger equation. Interpretation of  $\psi$ . Molecular orbitals treatment for homonuclear and heteronuclear diatomic molecules ( $H_2$  to  $F_2$ ). and (NO, HF, HCl).  $\pi$ -molecular orbitals of butadiene.

Crystal field theory and the energy level diagrams for transition metal ions (tetrahedral and octahedral) and their magnetic properties.

**Unit-II****9L+3T**

**Spectroscopic techniques and applications:** Principles of spectroscopy. Origin of Electronic spectroscopy. Fluorescence, Phosphorescence. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging.

**Unit-III****8L+2T**

**Use of free energy in chemical equilibria:** Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria.

**Unit-IV****6L +2T**

**Periodic properties:** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries.

**Unit-V****8L+ 2T**

**Stereochemistry:** Introduction, Basic concept in stereochemistry, optical isomerism, diastereomers, meso compounds, racemic mixture, and enantiomeric excess. Configuration, geometrical isomerism. Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Conformation analysis of ethane and n-butane.

**Unit-VI****6L+2T**

**Organic reactions and synthesis of a drug molecule:** Introduction of substitution, addition, elimination reaction. Mechanism of Industrially important organic reactions: Clemmensen reduction, Baeyer villiger, Diels Alder. Synthesis of a commonly used drug molecule (aspirin).

## Reference Books

1. University chemistry, by B. H. Mahan, Narosa Book Distributors (1998)
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane, McGraw-Hill; 3<sup>rd</sup> edition (1980)
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell, McGraw-Hill Inc., US; 3<sup>rd</sup> edition ( 1983)
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins, Oxford; 9<sup>th</sup> edition (2009)
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, W. H. Freeman; 7<sup>th</sup> edition (2014)

**List of Experiments**

S. No.	Name of Experiment.
1	To determine the total hardness of the water sample.
2	To determine the alkalinity of the water sample.
3	To determine the total residual chlorine in the given water sample.
4	To determine the dissolved oxygen in given sample of water.
5	To determine the total iron ( $\text{Fe}^{2+}$ and $\text{Fe}^{3+}$ ion) in the given mixture solution by $\text{KMnO}_4$ .
6	To determine the Ferrous ( $\text{Fe}^{2+}$ ) and Ferric ions ( $\text{Fe}^{3+}$ ) ions in the given mixture solution by $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator method.
7	To determine the saponification/acid value of an oil
8	To determine the rate of reaction.
9	To determination of the partition coefficient of a substance between two immiscible liquids
10	To determine the amount of $\text{Cu}^{++}$ by iodometric titration.
11	To determine the cell constant and conductance of solutions
12	To find the normality of an acid solution by conductometrically.
13	Synthesis of a polymer/drug
14	Adsorption of acetic acid by charcoal

Note: Out of fourteen experiments, ten experiments are to be performed.

**Reference Books :**

1. Lab Manual by School of Vocational Studies and Applied Sciences
2. Applied Chemistry: Theory and Practice by O.P. Vermani and A.K. Narula, New Age International Pvt. Ltd. Publishers ,2008
3. Vogels Textbook of Quatitative Chemical Analysis, Revised by G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney. ELBS, Longman, Essex U. K, 5<sup>th</sup> edn. 1996
4. Laboratory Manual on Engg. Chemistry by S.K.Bhasin and Sudha Rani, Dhanpat Rai Publishing Co. (P) Ltd., 2009