# SYLLABUS OF CHEMISTRY

## UGCHE- 01
## Atoms and Molecules

**Block -01**

**Structure of Matter-I**

**Unit-01-** Old Quantum Theory- Discovery of sub Atomic Particles, Earlier, Earlier Atom Models, Light as Electromagnetic Wave, Failures of Classical Physics, Plank Quantum Theory, Block Body Radiation, Heat Capacity Variation Einstein's Theory of Photoelectric Elect, Bohr Atom Model, Radius of Bohr's Theory, Critical Analysis of Bohr's Theory Refinements in the Atomic Spectra Spectra Theory.

**Unit-02**- Wave Mechanics- Nature of Radiation and Matter, Heisenberg Uncertainty Principle the Schrodinger Equation and its Application Hydrogen and Hydrogen- like Atom, Electron Configuration of Multi Electron Atoms.

**Unit-03**- Electronic Theory of Valence- Basic Theory- Electrovalent or lonic Bond, Covalent Bond- Bond Polarity, VSEPR Theory

**Unit-04**- Valence Bond Theory- Origin of Valence, Bond and Molecular Orbital Theories, principles of Valence Bond Theory, Valence Bond theory of Hydrogen Molecules, Resonance or Electron Delocalization, Valence Bond Description of Some more Molecules, Hybridization of Orbital, Valence Bond Description of Benzene.

**Unit-05**- Molecular Orbital Theory- LACO Theory, Homonuclear. Diatomic Molecules, Heteronuclear Diatomic Molecules, Comparison of Valence Bond and Molecular Orbital Theories.

**Block-II**

**Structure of Matter-II**

Molecular Properties- Polar and Non Polar Molecular, Dielictric Constant, Dipole Moment, Magnetic Properties of matter ; Molecular Spectroscopy-I; Molecular Spectroscopy-II; Nuclear Chemistry

## UGCHE -03
## Inorganic Chemistry-I

**Block-I Periodicity and S-Block Elements**

Periodic Table; Periodicity ; Hydrogen; Alkali Metals; Alkali Earth Metals

**Block-II**

**p- Block Elements –I**

Elements of Group- 13; Elements of Group- 14; Elements of Group- 15.

**Block-III p- Block Elements –II**

Elements of Group- 16; Elements of Group- 17; Elements of Group- 18

**Block-III d and f -Block Elements**

Transition Elements; Inner Transition Elements; Coordination Group; Isolation and participation of Metals

## UGCHE -04
## Physical Chemistry-I

**Block-I Chemical Equilbria and Electro Chemistry**

Chemical Equilibria; Ionic Equilibria; Electrolytic Conductance of Solutions; Electro Chemical Cells

**Block-II Dynamics and Macro Molecules**

Chemical Kinetics; Photo Chemistry; Colloids and Macro Molecules; Surface Chemistry and Catalysis

### Physical Chemistry-II

**Block-IV Chemical Equilibria and Electro Chemistry**

Chemical Equilibria; Ionic Equilibria; Electrolytic Conductance of Solutions; Electro Chemical Cells

**Block-V Dynamics and Macro Molecules**

Chemical Kinetics; Photo Chemistry; Colloids and Macro Molecules; Surface Chemistry and Catalysis

## UGCHE -05
## Organic Chemistry-I

**Block-I Fundamental Concept**

Bonding, Functional Group Classification and Nomenclature; Stereochemistry-I- Isomerism, Geometrical & Optical Isomerism; Stereochemistry-II Configuration and Fischer Projection Formulas, Asymmetric Synthesis, Walden Inversion, Conformational Isomers, Ethane, Butane, and Cyclic Systems; Effect of Molecular Architecture on Physical Properties- General Ideas about the Spectroscopy, Ultraviolet Spectroscopy, Nuclear Magnetic Resonance Spectroscopy Mass Spectrometry; Structure Reactivity Relationships

**Block-II Basic Skeleton: Hydrocarbons and Heterocyclics**

Alkanes; Alkenes; Alkynes; Aromatic Hydrocarbons and Polynuclar Aromatics; Heterocyclic Compounds

**Block-III Derivatives of Hydrocarbons-I**

Halogen Derivatives; Alcohols and Phenols; Ethers and Sulphur Analogues of Alcohols and Ethers; Aldehydes and Ketones.

**Block-IV Derivatives of Hydrocarbons-II**

Monocarboxylic and Sulphonic Acids; Substituted Carboxylic Acids; Functional Derivatives of Monocarboxylic Acids; Nitro Compounds; Amino Compounds and Diazonium Salts; Natural Products

## UGCHE -09
## Biochemistry

**Block-I**

Biomolecules-I; Cell Structure and Function; Carbohydrates; Lipids; Nucleic Acids

**Block-II**

Biomolecules-II; Proteins; Enzymes; Vitamins Coenzymes and Miwralls

**Block-III**

Bioenergetics and Metabolism**;** Bioenergetics**;** Metabolism Regulation**;** Photosynthesis

**Block-IV**

Gene Expression; Replication and Transcription; Protein Biosynthesis; Biotechnology; Immunology

## UGCHE -10
## Spectroscopy

**Block-I Basic Concept and Rotational Spectra**

Spectra of Atoms ; Symmetry of Molecules ; Rotational Spectra

**Block-II IR and Raman Spectra**

Vibratinal Spectra of Diatomic Molecules**;** Infrared Spectra of Polyatomic Molecules **;** Raman Spectroscopy

**Block-III Electronic Spectra and Instrumentation**

Electronic Spectra-I born- Oppenheimer Appoximation, Electronic States of Diatomic Molecules, Franck- Condor, Principal, Electronic Spectra, Polyatomic Molecules, Carbonyl Chromophore; Electronic Spectra-II Models for Metal, ligand and Interactions, Crystal field theory, Deexcitation Processes in electronic Spectroscopy; Optical Spectroscopy: Instrumentation and Sampling.

**Block-IV Resonance Spectroscopy and Mass Spectrometry**

Nuclear Magnetic Resonance Spectroscopy; Electron Spin Resonance Spectroscopy; Mass Spectrometry; Exercises in Problem Solving using IR, UV, NMR and Mass Spectral Techniques

## UGCHE-11
## Mathematical Methods

**Block-I Algebra and Geometry**

Sets and Functions; Graphs and Functions; Elementary Algebra; Coordinate Geometry; Vectors

**Block-II Calculus**

Differential Calculus; Applications of Differential Calculus; The Integral; Integration of Elementary Functions; Differential Equations

**Block-III Probability Distributions**

Statistics; Probability; Discrete Probability Distributions; Continuous Probability Distributions

**Block-IV Statistical Inference**

Sampling (Statistical data Sampling); Hypothesis Tests; Correlation and Regression

## UGCHE-12
## Organic Reaction Mechanism

**Block -1**

Unit-1 Reaction Mechanism -Introduction

Unit-2 Kinetic Mechanism of Reactions
Unit-3 Aliphatic Nucleophilic substitutions
Unit-4 Aromatic Electrophilic substitutions

**Block-2**

Unit-5 Addition to Carbon-Carbon Multiple bond system
Unit 6 Nucleophilic Addition to Carbonyl Compounds
Unit-7 Elimination Reaction
Unit-8 Oxidation and Reduction

**Block -3**

Unit-9 Carbenes, Nitrenes and Benzynes
Unit-10 Free Radicals
Unit-11 Molecular Rearrangement
Unit-12 Pericyclic Reactions

**Block -4**

Unit-13 Organic Photochemistry
Unit-14 Strategy of Organic Synthesis
Unit-15 Case Study of Some Chemicals of Daily Use-I
Unit-16 Case Study of Some Chemicals of Daily Use-II

## UGCHE-13
## Statistical Methods

### BLOCK – I . Data Collection and Its Representation

**Data Collection and Tabulation :**

Meanings, Definitions and Applications of Statistics, Measurements and Scale, Measurements of qualitative data, Methods of data collection, Types of data.

**Representation of Data- I (Diagrammatical representation):**

Frequency distribution, Tabulation of data, Diagrammatical Representation of data, Bar diagram, Multiple bar diagram, Divided bar diagram, Percentage bar diagram, Pie chart, Pictogram, leaf chart,

**Representation of Data- I (Graphical representation):**

Graphical representation of frequency distribution, Histogram, Frequency polygon, Frequency curve, Ogive.

### BLOCK – II . Measures of Central Tendency and Dispersion

**Measures of Central Tendency :**

Types of measures of central tendency, Arithmetic mean, Fundamental Theorems on
Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode, Percentiles, Deciles, and Quartiles.

**Measures of Dispersion :**

Types of measures of Dispersion, Range, Mean Deviation, Variance and Standard deviation, Effect of change of origin and scale, Relationship between measures of central tendency and measures of dispersion, Coefficient of variation.

**BLOCK – II . Moments, Skewness and Kurtosis**

**Moments, Raw Moments and Central Moments :**
Definition of moments, raw moments for ungrouped data, raw moments for grouped data, Central moments, Factorial moments, Interrelationship between various moments, effect of change of origin and scale on moments, Charlier's checks, Sheppard"s correction for moments.
**Skewness and Kurtosis :**
Definition of skewness, Measures of skewness, Pearson's coefficient, Bowley's coefficients, Kurtosis, Measures of Kurtosis, effect of change of origin and scale.

## UGCHE (L)-1
## Chemistry Lab-3

**Block 1 : Preparatory Organic Chemistry**

Techniques and Apparatus; Organic Preparations

**Block 2 : Qualitative Organic Analysis**

Preliminary Qualitative Analysis; Qualitative Classification Tests and Preparation of Derivatives; Qualitative Classification Tests and Preparation of Derivatives-II

## UGCHE (L)-1
## Chemistry Lab-4

**Block 1 : Laboratory Skills and Techniques**

Basic Lab Skills ; Handling of Data; Use of Instruments—Low Cost Instruments

**Block 2 : Properties of Liquids and Thermochemistry**

Surface Tension of an Aqueous Solution; Viscosity of NaCl/$CuSO_4$/Cane Sugar Solution; Enthalpy of Solution; Enthalpy of Neutralisation

**Block 3 : Application of Thermodynamics**

Depression of Freezing Point—Rast Method; EMF Measurements; Adsorption — Oxalic Acid on Charcoal; Phase Equilibria-I; Phase Equilibria-II

**Block 4 : Chemical Kinetics**

Basic Concepts; Initial Rate Method; Integrated Rate Equation Method

## UGCHE (L)-1
## Chemistry Lab-6 (Lab-I+Lab-II)

**Block 1 : Quantitative Analysis-I**

Laboratory Techniques and Procedures ; Acid-Base Titrations-I; Acid-Base Titrations-II

**Block 2 : Quantitative Analysis-II**

Estimation of Iron; Estimation of Copper; Estimation of Water

**Block 1 : Inorganic Preparations and Gravimetry**

Apparatus and Experimental Techniques; Inorganic Preparations; Gravimetric Analysis

**Block 2 : Qualitative Inorganic Analysis**

Detection of the Anions; Detection of the Cations-I; Detection of the Cations-II