

**Chanda Shikshan Prasarak Mandal's  
JANATA MAHAVIDYALAYA, CHANDRAPUR  
DEPARTMENT OF CHEMISTRY  
UG CHEMISTRY DEGREE PROGRAM  
Program specific outcomes (PSOs), Course outcomes (COs)**

**PROGRAM SPECIFIC OUTCOMES (PSOs) –**

**After completion of B.Sc. with chemistry as one of the subjects, Students will-**

**PSO1:** have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Inorganic, Organic and physical chemistry.

**PSO2:** be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

**PSO3:** be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problem.

**PSO4:** be able to explore new area of research in both chemistry and related field.

**PSO5:** appreciate the central role of chemistry in our society and able to function as a member of an interdisciplinary problem solving team.

## **COURSE OUTCOMES B.Sc. SEM-I**

### **PAPER I: INORGANIC CHEMISTRY**

After completion of this course students will gain -

**CO1:** an understanding of atomic structure in detail and different principles which are useful to write the electronic configuration of different elements.

**CO2:** an understanding of molecular orbital theory and different M.O. diagrams of related molecules.

**CO3:** an understanding of s-Block elements in detail and understanding of p-Block elements in detail.

**CO4:** an understanding of classification of hydrogen bonding and understanding of chemistry of noble gases and different theories involved in volumetric analysis.

### **PAPER-II: CODE: USCHT02: ORGANIC CHEMISTRY**

After completion of this course students will gain -

**CO1:** knowledge of fundamentals of organic chemistry like classification, electronic movement in organic compounds, type of reagents, Reaction intermediates, types of chemical reactions and its applications in organic chemistry

**CO2:** knowledge of stereochemistry and be able to write structure of organic compound in three dimensional way.

**CO3.** An understanding of nomenclature, classification, orbital pictures, method of formation, physical and chemical properties, Reaction mechanism, applications of alkanes, alkene, alkadienes, alkyne, cycloalkanes.

**CO4:** An understanding of aromatic compounds, Hucel rule for aromaticity, orbital pictures of benzene, Electrophilic Aromatic Substitution reactions and mechanism, Effect of substituent on reactivity of aromatic compounds

### **CODE: USCHP01: CONTENT 15: EXPERIMENTS**

After completion of this course students will -

**CO1:** be able to handle different chemicals, laboratory instruments and glassware.

**CO2:** develop skill in titration and understand principle involved in titration.

**CO3:** acquire basic knowledge in evaluation of analytical data and embodied in practical record.

**CO4:** be able to identify organic compounds qualitatively by performing preliminary test, elements detection, functional group identification, preparation of derivative and recording melting point of compounds and derivatives.

## COURSE OUTCOMES

### B.SC. SEM-II

#### PAPER-I: CODE: USCHT03: ORGANIC CHEMISTRY

After completion of this course students will -

**CO1:** be able to know nomenclature, classification, orbital pictures, method of generation, physical and chemical properties, Reaction mechanism, applications of alkyl halide and aryl halide.

**CO2:** be able to understand nomenclature, classification, orbital pictures, method of generation, physical and chemical properties, Reaction mechanism, and applications of aliphatic aldehyde monohydric alcohol, dihydric alcohol, phenols and aliphatic and aromatic ethers.

**CO3:** become familiar with nomenclature, classification, orbital pictures, method of generation, physical and chemical properties, Reaction mechanism, applications of aliphatic carbonyl compounds like formaldehyde, acetaldehyde, acetone, benzaldehyde and benzophenone.

**CO4:** be able to know nomenclature, classification, orbital pictures, method of generation, physical and chemical properties, Reaction mechanism, applications of mono carboxylic acid, dicarboxylic acid like succinic acid, phthalic acid and their derivatives like acid chloride, amide, ester and unhydride.

#### PAPER-II: Code USCChT04: Physical Chemistry

After completion of this course students will gain -

**CO1:** an understanding of mathematical concepts i.e., Logarithmic relations, Linear graphs, calculation of slopes, differentiation of functions like  $kx^m$ ,  $e^x$ ,  $\sin x$ ,  $\log x$  etc. maxima and minima, Integration of useful / relevant functions.

**CO2:** an understanding of ionic equilibrium involved in physical chemistry.

**CO3:** an understanding of all thermodynamic terms, first law of thermodynamics and concept of thermo chemistry.

**CO4:** an understanding of different terms and theories involved in gaseous state, properties of liquid i.e., surface tension and understanding of different laws involved in solid states.

#### CODE: USCHP02: CONTENT: 20 EXPERIMENT

#### AFTER COMPLETION OF THIS COURSE

They will be able to know one step synthesis of organic compounds and their characterization by finding melting point. They will know about physical chemistry practical in regard to principle and application.

## **COURSE OUTCOMES**

### **B.Sc. SEM-III**

#### **PAPER-I: Code- USCChT05: Inorganic Chemistry**

After completion of this course student will gain-

**CO1:** An understanding of hydrides of boron, basic properties of iodine, inter- halogen compounds and oxy acids of sulphur and silicates.

**CO2:** An understanding of ionic solids, metallic bonding and about acids and bases.

**CO3:** An understanding of first, second, and third transition elements.

**CO4:** An understanding of chemistry of lanthanides and actinides.

#### **PAPER-II: Physical Chemistry**

**After completion of this course students will gain -**

**CO1:** an understanding of thermodynamic concepts, first law of thermodynamic and concept of thermo chemistry.

**CO2:** an understanding of second law of thermodynamic, need and application of second law of thermodynamic, free energy functions, system of variable compositions

**CO3:** an understanding of phase rule, applications and derivation of phase rule, liquid-liquid mixtures, partial miscible liquid, immiscible liquid.

**CO4:** an understanding of concept and terms in Crystallography, derivation of Bragg's equation, determination of crystal structure of NaCl, KCl, and CsCl by Laue's method and powder method

Contents: 15 Experiments

**After completion of this course –**

**CO1:** Students will design and conduct an experiment acid-base titration and demonstrate their understanding of the scientific method..

**CO2:** Students will demonstrate an understanding of the heat of solution (series of experiments ) required to interpret and analyze results and draw conclusions as supported by their data.

## **COURSE OUTCOMES**

### **B.Sc. SEM-IV**

**PAPER-I:** Code- USChT07 : Inorganic Chemistry

After completion of this course student will gain-

**CO1:** An understanding of co-ordination compounds in detail.

**CO2:** An understanding of hard acids and soft acids and bases and oxidation and reduction.

**CO3:** An understanding of metal- ligand bonding in transition metal complexes and electronic spectra of transition metal complexes.

**CO4:** An understanding of thermodynamic and kinetic aspects of metal complexes and information **about colorimetry and spectrophotometry.**

**PAPER-II: Organic Chemistry**

After completion of this course students will gain -

**CO1:** an understanding of concept and terms of electromagnetic spectrum, Ultraviolet absorption spectroscopy and infra red spectroscopy.

**CO2:** an understanding of term and reactions of carboxylic acid, carboxylic acid derivatives and reactions

**CO3:** an understanding of term and reactions of nitro compounds, amino compounds, reactions and applications.

**CO4:** an understanding of concept of quantitative analysis, reactions of enolates and applications, concept of organometallic compounds, reactions and applications.

### **CONTENT 15: EXPERIMENT**

#### **AFTER COMPLETION OF THIS COURSE**

**CO1:** The students will be able to handle different chemicals, laboratory instruments and glassware. They will develop skill in titration and understand principle involved in titration. They will acquire basic knowledge in evaluation of analytical data and embody in practical record. They will be able to identify organic compounds qualitatively by performing preliminary test, elements detection, functional group identification, preparation of derivative and recording melting point of compounds and derivatives.

**CO2:** The students will be able to understand concepts of gravimetric analysis and conduct the experiments.

## COURSE OUTCOMES

### B.Sc. SEM-V

#### PAPER-I (Organic Chemistry)

##### Unit I:

After completion of this course students will gain -

**CO1:** an understanding of Nuclear Magnetic Resonance Spectroscopy.

**CO2:** an understanding of nuclear shielding, deshielding, chemical shift, Spin-spin splitting and coupling constant..

**CO3:** an understanding of Interpretation of NMR spectra of organic molecules.

**CO4:** Learning problem pertaining to the structure elucidation of simple organic molecules by NMR technique.

##### Unit II:

After completion of this course students will gain -

**CO1:** an understanding of Molecular orbital picture and aromaticity of furan, thiophene, pyrrole and pyridine.

**CO2:** an understanding of structure of pyridine, methods of synthesis of pyridine and chemical reaction of pyridine.

**CO3:** an understanding of introduction to condensed five and six membered heterocycles.

**CO4:** an understanding of method of preparation and chemical reactions of umpolung, Sulphur Ylides, LDA (Lithium diisopropyl amide) and Woodward and Prevost Hydroxylation.

##### Unit -III

After completion of this course students will gain -

**CO1:** an understanding of definition, classification, reaction and structure of glucose.

**CO2:** an understanding of determination of ring size of glucose by Haworth methylation process.

**CO3:** an understanding of Classification, structure and stereochemistry of amino acids.

**CO4:** an understanding of Classification, structure and nomenclature of peptides and protein.

##### Unit 04            Contents: Synthetic dyes and Drugs

After completion of this course students will gain -

**CO1:** an understanding of Colour and constitution (Witt's theory, electronic concept)

**CO2:** an understanding of Classification of Dyes based on chemical constitution.

**CO3:** an understanding of Synthesis and uses of methyl orange Congored, Crystal violet, Phenolphthalein, Alizarin and indigo dye.

**CO4:** an understanding of definitions, qualities of ideal drugs, Basic terminology of drugs.

**CO5:** an understanding of Synthesis and Applications of (i) Aspirin (ii) Paracetamol (iii) Chloroquine (iv) Chloramphenicol (v) Phenobarbital, and their side effects.

## **PAPER-II**

### **COURSE OUTCOMES**

#### **Contents: Physical Chemistry**

After completion of this course students will gain -

**CO1:** An understanding of concept of electrical conductivity, transport number explains the various methods for the determination of transference number and conductometric Titrations.

**CO2:** An understanding of basic knowledge of electrode potentials & electrochemical cells.

**CO3:** Students will be familiar with the main aspects of the historical development of quantum mechanics and be able to discuss and interpret experiments that reveal the wave properties of matter.

**CO4:** An understanding of concept of different concentration terms, colligative properties and Magnetic properties of substances.

**CO5:** qualitative analyzing skills, an understanding of theoretical concept by performing experiments.

#### **Experiments      Contents: Organic and Physical Chemistry**

After completion of this course students will -

**CO1:** design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on analysis.

**CO2:** demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

## **SEM-VI**

### **PAPER-I**

#### **COURSE OUTCOMES**

##### **Unit 01:**

**After completion of this course students will gain -**

**CO1:** an understanding of crystal field theory.

**CO2:** an understanding of Factors affecting the Magnitude of  $10Dq$ .

**CO3:** an understanding of Crystal field stabilisation energy of Octahedral and Tetrahedral complexes (Numerical).

**CO4:** development of problem solving skills, logical and critical thinking through numerical.

##### **Unit 02:**

**After completion of this course students will gain -**

**CO1:** an understanding of determining of Magnetic Susceptibility by Gouy's method.

**CO2:** an understanding Spin formula and orbital contribution to magnetic moment.

**CO3:** an understanding of Magnetic properties of Octahedral and Tetrahedral complexes with respect to CFT.

**CO4:** an understanding of Thermodynamic and Kinetic stability of metal complexes, their relation.

### **Unit 03**

#### **After completion of this course students will gain -**

**CO1:** an understanding of Principles of photometry: Beer-Lamberts Law and its deviation.

**CO2:** an understanding of types of colorimeter and spectrophotometer with simple schematic diagrams.

**CO3:** an understanding of Application of colorimeter and spectrophotometer in quantitative analysis.

**CO4:** an understanding of Principles and Classification of Chromatography and Solvent Extraction.

**CO5:** an understanding of Types of ion exchange resins, Equilibria and ion exchange capacity, Application in separation of binary mixtures.

### **Unit 04:**

#### **After completion of this course students will gain -**

**CO1:** an understanding of Definition, Nomenclature and Classification of Organometallic compounds.

**CO2:** an understanding of preparation, properties and application of Alkyl and Aryls of Al, Hg and Sn.

**CO3:** an understanding of Essential and Trace elements in biological processes.

**CO4:** an understanding of biological role of Na<sup>+</sup> and K<sup>+</sup> and Ca<sup>2+</sup> metal ions.

**CO5:** an understanding of chemical analysis of soil, Collection of soil Sample, Method of analysis, Soil pH, Soil Salinity, Organic carbon, available phosphorous and potassium, Lime requirements.

### **PAPER-II**

#### **CHE 02 Contents: Physical Chemistry**

#### **After completion of this course students will gain -**

**CO1:** an understanding of Schrodinger wave equation for hydrogen atom,

**CO2:** an understanding of Interaction of radiation with matter,

**CO3:** an understanding of Spectroscopy, Rotational spectra of diatomic molecules, Application of rotational spectra for determination of bond length of diatomic molecules

**CO4:** an understanding of Surface Chemistry, freundlich adsorption isotherm, Langmuirs theory of adsorption, Adsorption chromatography and concept of colloidal chemistry.

#### **Chemistry Practicals Contents: 10 experiments**

#### **After completion of this course -**

**CO1:** Students will design and conduct experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on spectroscopy, photochemistry and colloidal chemistry.

**CO2:** Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.