

## Department of Chemistry

### Syllabus 2023 onwards

### B.Sc. Chemistry-Course Outcomes

#### SEMESTER – I

#### U23CHT101 – GENERAL CHEMISTRY - I

##### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

- |            |   |
|------------|---|
| <b>CO1</b> | Explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.  |
| <b>CO2</b> | Classify the elements in the periodic table, types of bonds, reactions intermediate electronic effects in organic compounds, types of reagents.   |
| <b>CO3</b> | Apply the theories of atomic structures, bonding, to calculate energy of spectral transitions, $\Delta x$ , $\Delta p$ electron gravity, percentage ionic character and bond order.             |
| <b>CO4</b> | Evaluate the relations existing between electronic configuration, bonding, geometry of molecules and reactions; structure activity and electronic effects.                                      |
| <b>CO5</b> | Construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms. |

#### U23CHP101 – ORGANIC ANALYSIS AND ORGANIC ESTIMATION

**CO1** Estimate the amount of an organic compound in each solution.

**CO2** Identify the presence of special elements and functional group in an unknown organic compound performing systematic analysis.

**CO3** Compare mono and dicarboxylic acids, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing & non-reducing sugars and explain the reactions behind it.

**CO4** Exhibit a solid derivative with respect to the identified functional group.

## U23CHE11 – FUNDAMENTALS OF CHEMISTRY

| CO  | Course outcomes   | Remarks |
|-----|---|---------|
| CO1 | Students can gain the knowledge on the handling of chemicals and errors in chemical analysis.                     | K2, K3  |
| CO2 | Learn Chemical Bonding and Hybridization  | K2      |
| CO3 | Learn the calculations of preparing standard solutions  | K2, K3  |
| CO4 | Understand and appreciate the advanced concepts and rate equations in chemical kinetics.                          | K2      |
| CO5 | Calculate change in thermodynamic properties, equilibrium constants, partial molar quantities, chemical potential | K2      |

**K1- Remember**

**K2- Understand**

**K3- Apply**

**K4- Analyze**

**K5-Evaluate**

## U23CHS11A – FOOD CHEMISTRY

**CO1** Learn about Food adulteration-contamination of Wheat, Rice, Milk, Butter.

**CO2** Get an awareness about food poisons like natural poisons (alkaloids-nephrotoxin)pesticides, DDT, BHC, Malathion

**CO3** Get an exposure on food additives, artificial sweeteners, Saccharin, Cyclamate and Aspartate in the food industries.

**CO4** Acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.

**CO5** Study about fats and oils-Sources of oils- production of refined vegetable oils-preservation. Saturatedand unsaturated fats–MUFA and PUFA

## U23CHS11B – ROLE OF CHEMISTRY IN DAILY LIFE

### **Course Learning Outcomes (for Mapping with Pos and PSOs) On completion of the course**

**CO1:** Learn about the chemicals used in everyday life as well as air pollution and water pollution.

**CO2:** Get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC bakelite, polyesters,

**CO3:** Acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats Also have an awareness about Cosmetics Toothpastes, face powder, soaps and detergents.

**CO4:** Discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel-examples and uses

**CO5:** Have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications

## U23CHF11 – FOUNDATION COURSE

**CO1:** Appreciate the evolution of chemistry and the chemists who contributed for chemistry.

**CO2:** Demonstrate the lab safety-regulatory requirements, procedures in chemical splashes.

**CO3:** Explain the principles of volumetric analysis.

**CO4:** Discuss the principles of qualitative analysis.

**CO5:** Appreciate the impact of chemistry in human life.

## SEMESTER – II

### U23CHT202 – GENERAL CHEMISTRY - II

CO1 Explain the concept of acids, bases and ionic equilibria; periodic properties of s and p-block elements, preparation and properties of aliphatic and aromatic hydrocarbons.

CO2 Discuss the periodic properties of s and p-block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids.

CO3 Classify hydrocarbons, types of reactions, acids and bases, examine the properties and reaction mechanisms of aliphatic and aromatic hydrocarbons.

CO4 Explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements.

CO5 Assess the application of hard and soft acids indicators, buffers, compounds of s and p-block elements.

### U23CHP202 – QUANTITATIVE INORGANIC ESTIMATION AND INORGANIC PREPARATION

#### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

On successful completion of the course the students should be able to

**CO1** Explain the basic principles involved in titrimetric analysis and inorganic preparations.

**CO2** Compare the methodologies of different titrimetric analysis

**CO3** Calculate the concentrations of unknown solution in different ways and develop the skill to estimate the amount of a substance present in a given solution.

**CO4** Assess the yield of different inorganic preparations and identify the end point of various titrations.

## U23CHE21 – VOLUMETRIC ANALYSIS

| <b>CO</b>  | <b>Course outcomes</b>   | <b>Remarks</b> |
|------------|--|----------------|
| <b>CO1</b> | Learn the concept of Titration methods and various Titrations                    | <b>K2</b>      |
| <b>CO2</b> | Understand the Acidimetry and alkalimetry titrations                             | <b>K2</b>      |
| <b>CO3</b> | The preparation of standard solutions and methods of analyze the various salts   | <b>K2, K4</b>  |
| <b>CO4</b> | Understand the calculations of molarity, molality and Normality of the solutions | <b>K2</b>      |

## U23CHS23 – ENTREPRENEURIAL SKILLS IN CHEMISTRY

### **Course Learning Outcomes (for Mapping with POs and PSOs)**

**On completion of the course the students should be able to**

**CO1:** Identify adulterated food items by doing simple chemical tests.

**CO2:** Prepare cleaning products and become entrepreneurs

**CO3:** Educate others about adulteration and motivate them to become entrepreneurs.



## SEMESTER – III

### U23CHT303 – GENERAL CHEMISTRY - III

#### Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

**CO1:** explain the kinetic properties of gases by using mathematical concepts.

**CO2:** describe the physical properties of liquid and solids; identify various types of crystals with respect to their packing and apply the XRD method for crystal structure determinations.

**CO3:** investigate radioactivity, nuclear energy and its production, also nuclear waste management.

**CO4:** write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.

**CO5:** investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol.

### U23CHP303 – QUALITATIVE INORGANIC ANALYSIS

On successful completion of the course the students should be able to

**CO1:** acquire knowledge on the systematic analysis of Mixture of salts.

**CO2:** identify the cations and anions in the unknown substance.

**CO3:** identify the cations and anions in the soil and water and to test the quality of water.

**CO4:** assess the role of common ion effect and solubility product

## SEMESTER – III

### SKILL ENHANCEMENT COURSE - NON MAJOR ELECTIVE

#### U23CHSN34 – COSMETIC CHEMISTRY

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

**CO 1:** describe the types of cosmetics. skin types, skin care products and role of calcium in the regulation of skin barrier homeostasis skin pH and skin flora.

**CO 2:** Choose cosmetics upon checking harmless chemical ingredients from various products

**CO 3:** discuss the basic idea about colour cosmetics

**CO 4:** explain the procedures of dental product and bath product.

**CO 5:** explain the preparation of perfume and flavours.

#### U23CHEA33 – ANCILLARY CHEMISTRY

**Course Learning Outcomes (for Mapping with POs and PSOs)**

**On completion of the course the students should be able to**

**CO 1:** handle the chemicals and first aid procedures.

**CO 2:** gain in-depth knowledge about the theories of chemical bonding,

**CO 3:** explain the principles of volumetric analysis.

**CO 4:** explain the concepts of chemical kinetics.

**CO 5:** explain various thermodynamic principles.

#### SEM –IV - U23CHEA44 – ANCILLARY CHEMISTRY PRACTICALS

**Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to**

**CO1:** To gain an understanding of the use of standard flask and volumetric pipettes, burette.

**CO2:** To design, carryout, record and interpret the results of volumetric titration.

**CO3:** To apply their skill in the analysis of water/hardness.

**CO4:** To analyze the chemical constituents in allied chemical products

## SEMESTER – IV

### U23CHT404 – GENERAL CHEMISTRY - IV

#### U23CHP404 – GRAVIMETRIC ESTIMATION AND ORGANIC PREPARATION

##### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** explain the principles of gravimetric analysis.

**CO2:** demonstrate the quantitative estimation of inorganic compound gravimetrically.

**CO3:** do the preparation of organic compounds.

**CO4:** exhibit recrystallisation of the crude sample

### SKILL ENHANCEMENT COURSE - NON MAJOR ELECTIVE

#### U23CHSN46 – APPLIED CHEMISTRY

##### Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

**CO 1:** explain the Natural and synthetic rubber composition.

**CO 2:** differentiate natural and artificial fibers.

**CO 3:** describe the distinction between resins and plastics.

**CO 4:** remember the classification of plastics and properties.

**CO5:** appreciate the importance of fertilizers.



## SEMESTER – V

### U23CHT505 – ORGANIC CHEMISTRY - I

#### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** assign RS notations to chirals and EZ notations to alkenes and explain conformations of ethane and butane.

**CO2:** explain preparation and properties of aromatic and aliphatic nitro compounds and amines

**CO3:** explain colour and constitution of dyes and food additives

**CO4:** discuss preparation and properties of five-membered heterocycles like pyrrole, furan and thiophene

**CO5:** discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

### U23CHT506 – INORGANIC CHEMISTRY - I

#### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** explain isomerism, Werner's Theory and stability of chelate complexes

**CO2:** discuss crystal field theory, magnetic properties and spectral properties of complexes.

**CO3:** explain preparation and properties of metal carbonyls

**CO4:** give a comparative account of the characteristics of lanthanoids and actinoids

**CO5:** explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous.

## U23CHT507 – PHYSICAL CHEMISTRY - I

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellingham's

**CO2:** apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.

**CO3:** compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogeneous and heterogeneous catalysis.

**CO4:** demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.

**CO5:** utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

## U23CHP505 – PHYSICAL CHEMISTRY PRACTICAL

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** Describe the principles and methodology for the practical work.

**CO2:** Explain the procedure, data and methodology for the practical work

**CO3:** Apply the principles of phase rule and electrochemistry for carrying out the practical work

**CO4:** Demonstrate laboratory skills for safe handling of the equipment and chemicals

## U23CHE55A – SPECTROSCOPY AND ANALYTICAL TECHNIQUES

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:**explain electrical and magnetic properties of materials and microwave spectroscopy

**CO2:**explain theory, instrumentation and applications of Infrared and Raman spectroscopy

**CO3:**apply selection rules to understand spectral transitions, explain Woodward-Fieser's rule for the calculation of wavelength maximum of conjugated dienes

**CO4:** explain theory, instrumentation and applications of NMR spectroscopy

**CO5:**explain theory, instrumentation and applications of Mass spectrometry

## U23CHE55B – INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:**apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry

**CO2:**explain theory, instrumentation and application of UV visible and Infrared spectroscopy.

**CO3:**able to discuss instrumentation, theory and applications of thermal and electrochemical techniques.

**CO4:**explain the use of chromatographic techniques in the separation and identification of mixtures.

**CO5:**explain preparation of solutions, stoichiometric calculations

## U23CHE56A – SBE-BIOCHEMISTRY

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:**explain molecular logic of living organisms, composition of blood and blood coagulation

**CO2:**explain synthesis and properties of aminoacids, determination of structure of peptides and proteins

**CO3:**explain factors influencing enzyme activity and vitamins as coenzymes

**CO4:**explain RNA and DNA structure and functions

**CO5:**explain biological significance of simple and compound lipids

## U23CHE56B – SBE-PHARMACEUTICAL CHEMISTRY

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:**Define the pharmaceutical terminologies; describe the principle sin pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.

**CO2:**Discuss the development of drugs, structural activity, disease types, physio-  
Chemical properties of therapeutic agents, significance of medicinal plants, clinical tests and factors for patentability.

**CO3:**Apply the principles involved in structural activity and drug designing, functions of haematological agents; estimation clinical parameters and therapeutic application of drugs form ajordiseases.

**CO4:**Explain classification of analgesics and anasthetics, and physiological functions of plasma protiens

**CO5:**Explain the significance of clinical tests like blood urea, serum proteins and coronary risk index



## SEMESTER – VI

### U23CHT608 – ORGANIC CHEMISTRY - II

#### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** Explain isolation and properties of alkaloids and terpenes.

**CO2:** Explain preparation and reactions of mono and disachharides.

**CO3:**Classify biomolecules and natural products based on their structure, properties, reactions and uses.

**CO4:**Explain molecular rearrangements like benzidine, Hoffmann etc.,

**CO5:**Preparation and properties of organolithium compounds

### U23CHT609 – PHYSICAL CHEMISTRY - II

#### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** Construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.

**CO2:** Apply the concepts of chemical equilibrium in dissociation of  $\text{PCl}_5$ ,  $\text{N}_2\text{O}_4$  and formation of  $\text{HI}$ ,  $\text{NH}_3$ ,  $\text{SO}_3$  and decomposition of calcium carbonate. Demonstrate important principles such as Le ,van't Hoff reaction isotherm and Clausius-Clayperon equation.

**CO3:** Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures ,partially miscible mixtures an dimmiscible liquids.

**CO4:** Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.

**CO5:** Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.



## U23CHE67A – NANO SCIENCE AND TECHNOLOGY

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** Explain the general concepts of nanoscience.

**CO2:** Describe the preparation of nanotubes and their applications.

**CO3:** Describe the classification nanostructured materials and its application.

**CO4:** Describe the nanoparticles and nano sensors.

**CO5:** Discuss applications of nanomedicines.

## U23CHE612 – POLYMER SCIENCE

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** Explain classification of polymers and mechanism of polymerization

**CO2:** Differentiate thermoplastic and thermosetting polymers.

**CO3:** Describe elastomers.

**CO4:** Demonstrate molecular weight determination and polymerization techniques of polymers.

**CO5:** Describe inorganic polymers.

## U23CHE68A – SBE-DAIRY CHEMISTRY

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** Understand about general composition of milk–constituents and its physical properties.

**CO2:** Acquire knowledge about pasteurization of Milk and various types of pasteurization-Bottle, Batch and HTST Ultra High Temperature Pasteurization.

**CO3:** Learn about Cream and Butter their composition and how to estimate fat in cream and Ghee

**CO4:** Explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.

**CO5:** Have an idea about how to make milk powder and its drying process-types of drying process

## U23CHE68B – SBE-TEXTILE CHEMISTRY

### **Course Learning Outcomes (for Mapping with Pos and PSOs)**

**On completion of the course the students should be able to**

**CO1:** Explain the importance of Natural Fibers and their applications to natural fiber.

**CO2:** Explain the Man- made fiber and its types.

**CO3:** Demonstrate pre-treatment of processing of dyes.

**CO4:** Explain the theory and classify dyes.

**CO5:** Explain the different methods of printing processes.