

## **BSc CHEMISTRY PROGRAMME**

### **Program Outcomes**

The students of BSc Chemistry at the time of graduation will be able to

PO1- Critical Thinking- Read, understand and interpret chemical information-verbal, mathematical, physical and graphical. The students are equipped to think critically by asking questions on the fundamental concepts in chemistry.

PO2- Generation of Skills- To impart skills required to gather information from resources and use them.

PO3- Effective Communication- Enabling students to interact positively and efficiently using English language and inculcating a culture of science discussion among the peers and society.

PO4- Making students Competitive- To give need based education in chemistry of the highest quality at the undergraduate level to make them competitive.

PO5- Decision Making- Offer courses to the choice of the students. This will make the students to take decisions by considering the pros and cons of the decisions they make.

PO6- Practical Skills- Perform experiments and interprets the results of observation. It will help the students to be efficiently participate in academic as well as industrial organizations.

PO7- Environment and Sustainability- To give the importance of green chemistry and educating them to utilize resources in a green method by limiting the use of organic solvents, hazardous chemicals etc.

PO8- Social Responsibility- Make the students socially responsible by giving awareness regarding the role of chemistry in social development. Making them actively participating in discussions about the destructive possibilities of science.

### **Program Specific Outcomes**

- Read, understand and interpret chemical information- verbal, mathematical and graphical.
- Impart skills required to gather information from resources and use them.
- To give need based education in chemistry of the highest quality at the undergraduate level.
- Offer courses to the choice of the students.

- Perform experiments and interpret the results of observation.
- Provide an intellectually stimulating environment to develop skills and enthusiasms of students to the best of their potential.
- Use Information Communication Technology to gather knowledge at will.
- Attract outstanding students from all backgrounds.

## **Course Outcome**

### **Semester 1**

#### **CH1CRT01- General and Analytical Chemistry**

CO1- To develop the scientific aptitude of students and critical thinking and equip them in pursuing chemistry as a career.

CO2- To have a fundamental idea regarding the elements of chemistry and periodic properties of atoms.

CO3- To develop scientific skills, observation and interpretation and evaluation of chemical analysis.

CO4- To have an insight on the separation, purification and isolation of compounds.

CO5- Enabling students to handle basic statistical tools for analyzing data.

### **Semester 2**

#### **CH2CRT02 – Theoretical and Inorganic Chemistry**

CO1- Make students to have ideas on the theory of atomic structure, electronic configuration and various rules for the filling up of electrons.

CO2- Various types of bonds, polarization of bonds and properties of ionic compounds. Valence bond theory, concept of resonance, hybridization, VSEPR theory and properties of covalent bonds. The students will be able to understand the fundamental attractive forces that unite atoms in a molecule.

CO3- Molecular Orbital theory of bonding, hydrogen bonding and applications. The students will be able to understand the advanced attractive forces that unite atoms in a molecule.

CO4- Enabling students to have an idea of the s and p block elements in the periodic table.

CO5- To have an idea regarding the transition metals, lanthanides and their applications.

## Semester 1 and 2 Core Chemistry Practicals

### **CH2CRP01- Volumetric Analysis**

CO1- Enabling students to manage neutralization titrations- acidimetry and alkalimetry.

CO2- Enabling students to manage complexometric titrations.

CO3- Enabling students to manage oxidation reduction (Redox) titrations like permanganometry, dichrometry, iodimetry and iodometry.

## Semester 3

### **CH3CRT03- Organic Chemistry- I**

CO1- Introducing students to the world of organic chemistry. Naming of organic compounds and the fundamental concepts in organic chemistry.

CO2- Various electronic displacement effects, cleavage of bonds, reagents, reactive intermediates and types of organic reactions. Students will be able to distinguish various organic molecules and predict their utility in organic synthesis.

CO3- Making students to visualize molecules. Understanding Optical isomerism and Geometrical isomerism with conformational analysis. Through this imagination of students will be tested.

CO4- The students are given opportunity to learn the reactions of alkanes, alkenes, alkynes and alkyl halides. Here they are performing experiments and interpret the results of observation.

CO5- Fundamental concepts of aromaticity- benzene, naphthalene, anthracene and aryl halides.

CO6- Introduction to pericyclic reactions with example. The intellectual aptitude will be increased with this course.

## Semester 4

### **CH4CRT04- Organic Chemistry- II**

CO1- Providing students to learn the basic reactions and properties of alcohols, phenols and ethers. Making students competitive with the knowledge of industrially important compounds.

CO2- Aldehydes and ketones are taught here. Preparation, properties and reactions of formaldehyde, acetaldehyde, acetone, benzaldehyde and benzophenone. Various named reactions are also introduced. Making students competitive with the knowledge of industrially important compounds.

CO3- Enabling the students to deal with carboxylic acids, sulphonic acids and their derivatives. Making students competitive with the knowledge of industrially important compounds.

## Semester 3 and 4 Core Chemistry Practicals

### **CH4CRP02- Qualitative Organic Analysis**

CO1- Equipping students for the qualitative analysis of organic compounds.

CO2- Indulging in experiments make the students more focused and oriented in both the theory and observation of the experiment.

CO3- Preparation of the derivatives of different compounds will make the students more competitive.

## Semester 5

### **CH5CRT05- Environmental Studies and Human Rights**

CO1- Students would be able to understand the multifaceted nature of environmental studies. He will be aware of the various resources and how to handle them effectively.

CO2- Making students to recognize the harmful effects of pollution and how to tackle the problems related to pollution. At the end he will transform to a socially responsible person.

CO3- Enabling students to get an idea about population explosion and related problems. Additionally student would be able to understand various environmental movements conducted.

CO4- Students will get awareness about ecological stress posed upon ecosystems by the presence of chemicals. Students are made aware of the various agencies that impose ecological stress.

CO5- Students are made known of their rights thereby motivating them to be a better person. Various rules are also introduced.

### **CH5CRT06- Organic Chemistry- III**

CO1- The nitrogen containing compounds are important class of compounds in organic chemistry. Preparation and reactions of various nitro compounds will make the students competitive.

CO2- Amines are industrially important compounds. Preparation, structure and reactivity of both aromatic and aliphatic amines will equip the students to work in industry. Diazonium salts are also fall in this category of industrially important compounds.

CO3- Students are given an opportunity to learn the various heterocyclic compounds and their applications. Students are made aware of the synthetic applications of these compounds.

CO4- Active methylene compounds find use in the synthesis of various industrially significant compounds. Preparation and reactions are also taught here.

CO5- An introduction to carbohydrates, their structure and reactivity and biological importance are also dealt here.

CO6- Classification of drugs, structure, therapeutic uses and mode of action of antibiotics, sulpha drugs, antipyretics, analgesics, antimalarials, antacids, anti-cancer drugs, anti-HIV agents, psychotropic drugs. By enabling the students by making aware of the drug addiction and abuse.

CO7- The fundamental and advanced applications of dyes and polymers will make the students aware of the industrial application of these compounds.

### **CH5CRT07- Physical Chemistry- I**

CO1- To make the students aware of the kinetic theory of gases and application of kinetic gas equation. Various critical phenomena are also discussed. Various distribution laws of molecular velocities are also included.

CO2- Liquid state is one of the important states of matter. Various properties of liquids are dealt here. Students will have an indepth knowledge in liquid state.

CO3- Students will be able to go deep in the solid state and crystallography. Various defects in crystal systems are also available to ponder. An introduction to liquid crystals is also dealt here.

CO4- Surface chemistry and colloidal state of materials will induce curiosity among the students and make them go further towards the deeper aspects of the subject.

### **CH5CRT08- Physical Chemistry- II**

CO1- To make the students aware of the fundamentals of classical mechanics and quantum mechanics. Applications of quantum mechanics to various systems are also discussed here. Molecular orbital theory is also dealt here.

CO2- An introduction to molecular spectroscopy. Various aspects of rotational, vibrational and Raman spectroscopy are also discussed. Students will be able to elucidate the structure of simple compounds using these methods.

CO3- Various aspects of electronic, NMR and ESR spectroscopy are also discussed. Students will be able to elucidate the structure of simple compounds using these methods.

### **CH5OPT01- Chemistry in Everyday Life**

CO1- An introduction to food additives like preservatives, flavours, sweetners, emulsifying agents, antioxidants and leavening agents.

CO2- Soaps and detergents are industrially important compounds. Detailed study of these items will enable the students to understand the chemistry behind these molecules.

CO3- Cosmetics is a field in which drastic changes are happening due to extensive research that is going on. A study of cosmetics will make the students aware of the damages that cosmetics can do in human body.

CO4- The students are given an introduction about plastics, paper and dyes and the environmental aspects of their uses.

CO5- A detailed study of drugs will enable the students to understand the various classification of drugs, their use, mode of action and abuse. Classification of drugs, structure, therapeutic uses and mode of action of antibiotics, sulpha drugs, antipyretics, analgesics, antimalarials, antacids, anti-cancer drugs, anti-HIV agents, psychotropic drugs. Enabling the students by making aware of the drug addiction and abuse.

CO7- The interrelationship between chemistry and agriculture, use of fertilizers, and their environmental hazards are well explained to the students. An introduction to nanomaterials also discussed here. The various terminologies involved in nanochemistry are also discussed.

## **Semester 6**

### **CH6CRT09- Inorganic Chemistry**

CO1- An introduction to coordination chemistry and structural aspects of coordination compounds.

CO2- Bonding present in coordination compounds are discussed. Crystal field theory will enable the students to interpret the splitting pattern of tetrahedral and octahedral complexes.

CO3- Reactivity of the coordination compounds are taught. SN1 and SN2 reactions and their mechanisms are also discussed here.

CO4- The students are given an introduction about organometallic compounds. Their naming, structure, reactions and applications are also discussed.

CO5- Basic concepts of bioinorganic chemistry, living systems and enzymes are also discussed here.

CO7- Boron compounds, interhalogen and noble gas compounds are included and the students might be able to understand the noble gas chemistry.

### **CH6CRT10- Organic Chemistry- IV**

CO1- An introduction to natural products like terpenoids and alkaloids.

CO2- Lipids are an important compound found in nature. Fats and oils, their properties soaps and detergents and their mode of action are also discussed here.

CO3- A brief study of vitamins, steroids and hormones are included here.

CO4- Classification of amino acids, peptides and proteins, their structure and reactions are also studied here.

CO5- Basic concepts of nucleic acids, living systems, enzymes and supramolecular systems are also discussed here.

CO7- Organic photochemistry and organic spectroscopy are taught here. Various aspects of rotational, vibrational and mass spectroscopy are also discussed. Students might be able to elucidate the structure of organic molecule at the end of the course.

### **CH6CRT11- Physical Chemistry- III**

CO1- Basic concepts of thermodynamics, first law, second law and third law are studied in detail. Mathematical and graphical tools are involved in it and students might be able to use them.

CO2- Law of mass action and chemical equilibria will enable the students to predict the direction of a chemical reaction in equilibrium.

CO3- A detailed study of ionic equilibrium will make the students to think critically and logically. Buffer solutions, its mode of action are also incorporated in this. Phase equilibrium also included in this.

CO4- Study of chemical kinetics will enable the students to determine the speed and rate of a chemical reaction. Effect of various parameters on reaction rate are also included. An introduction to catalysis is also given so that the students might be able to develop new systems.

### **CH6CRT12- Physical Chemistry- IV**

CO1- Fundamental and advanced studies of solutions. Solubility of gas in solutions are also included.

CO2- Electrical conductance, ionic mobility, transference number, various theories of electrical conductance and their applications are included in this. The students might be able to have a in depth knowledge in conductance.

CO3- Introduction to electromotive force, concentration cells, applications of emf measurements, potentiometric titrations, acid base titrations, redox titrations and indicators. Corrosion of metals also incorporated in this. Through this the students might be able to develop awareness of the daily life related utensils and their corrosion.

CO4- Photochemistry and group theory are incorporated in this. These advanced topics will help the students to develop scientific aptitude to advance in career.

### **CH6CBT02- Nanochemistry and Nanotechnology**

CO1- Introduction to the world of Nano chemistry. The fundamental concepts and historical evolution of nanotechnology will make the students more creative and enthusiastic.

CO2- The various microscopic techniques for the characterization of nanomaterials will fascinate the students and motivate them to go to the deep of Nano world.

CO3- Electrical and optical properties of nanomaterials are also incorporated which will develop curiosity and increase the scientific temper.

CO4- The students will be highly motivated when they study the different applications of nanotechnology.

### **Semester V & VI Practicals**

#### **CH6CRP03- Qualitative Inorganic Analysis.**

CO1- Study of the reactions of the acid and base radicals and the theory behind these reactions.

CO2- Systematic and qualitative analysis of the inorganic mixture of radicals will increase the skills of the students especially practical and observation.

#### **CH6CRP04- Organic Preparations and Laboratory Techniques.**

CO1- Basic Laboratory Techniques will give the students a hands-on training to determine the fundamental parameters of molecules like crystallization, distillation, solvent extraction etc.

CO2- Students are encouraged to synthesize simple organic molecules which will increase the practical and synthetic skills of the students.

CO3- Chromatographic techniques will enable the students to develop the skills to purify impure organic compounds.

#### **CH6CRP05- Physical Chemistry Practicals.**

CO1- To develop skills in doing experiments in kinetics, potentiometry and phase rule. Enable the students to prepare data analysis using spread sheet program.

#### **CH6CRP06- Gravimetric Analysis.**

CO1- Students would be able to precipitate different metal ions and estimation of these ions gravimetrically.



## **COMPLEMENTARY COURSE IN CHEMISTRY**

### **Semester 1**

#### **CH1CMT01- Basic Theoretical and Analytical Chemistry**

CO1- This course will provide an insight into some of the fundamental concepts and principles that are very essential in the study of chemistry.

CO2- To study atomic structure and fundamental concepts in chemistry.

CO3- Chromatographic techniques will enable the students to develop the skills to purify impure organic compounds.

CO4- The students will understand the fundamentals of principles of analytical chemistry.

### **Semester 2**

#### **CH2CMT02- Basic Organic Chemistry**

CO1- The students will understand some fundamental aspects of organic chemistry.

CO2- Students are motivated to study the mechanism of some organic reactions, classification of polymers, structure and uses of some commercial and natural polymers.

### **Semester 1 and 2 Complementary Chemistry Practicals**

#### **CH2CMP01- Volumetric Analysis**

CO1- Enabling students to manage neutralization titrations- acidimetry and alkalimetry.

CO2-. Enabling students to manage oxidation reduction (Redox) titrations like permanganometry, dichrometry, iodimetry and iodometry.

### **Semester 3**

#### **CH3CMT03- Physical Chemistry I**

CO1- To enable the students to get a clear idea about the molecular structure- Solids, liquids, gaseous and crystalline state.

CO2- To make students capable of understanding and studying electrical and nuclear properties of molecules.

CO3- To study the surface chemistry of materials and phase equilibrium.

#### **CH3CMT04- Inorganic and Organic Chemistry**

CO1- This course will promote understanding facts and concepts in inorganic and organic chemistry.

CO2- This will give the students a basic understanding of nuclear chemistry and heterocyclic compounds and various types of food additives, cosmetics and drugs.

CO3- To study the surface chemistry of materials and phase equilibrium.

#### **CH4CMT05- Physical Chemistry II**

CO1- This course will promote understanding facts and concepts in spectroscopy.

CO2- Introduction to the world of Nano chemistry. The fundamental concepts and historical evolution of nanotechnology will make the students more creative and enthusiastic.

CO3- This will give the students a basic understanding of kinetics, catalysis, photochemistry and electrochemistry of molecules.

#### **CH4CMT06- Advanced Bio organic Chemistry**

CO1- An introduction to natural products like terpenoids and alkaloids.

CO2- Lipids are an important compound found in nature. Fats and oils, their properties soaps and detergents and their mode of action are also discussed here.

CO3- A brief study of vitamins, steroids and hormones are included here.

CO4- Classification of amino acids, peptides and proteins, their structure and reactions are also studied here.

CO5- Basic concepts of nucleic acids, living systems, enzymes and supramolecular systems are also discussed here.

### **Semester 3 and 4 Complementary Chemistry Practicals**

#### **CH4CMP02- Physical Chemistry Practicals**

CO1- To develop skills in doing experiments in kinetics, potentiometry and phase rule. Enable the students to prepare data analysis using spread sheet program.

### **CH4CMP03- Organic Chemistry Practicals**

CO1- Equipping students for the qualitative analysis of organic compounds.

CO2- Indulging in experiments make the students more focused and oriented in both the theory and observation of the experiment.

CO3- Preparation of the derivatives of different compounds will make the students more competitive.