



ESTD. IN 1965

## St. Mary's College

Sulthan Bathery, Wayanad, Kerala-673592

Phone: +91 4936 220246, 225246

Email: [stmaryssby@gmail.com](mailto:stmaryssby@gmail.com)

## Learning Outcomes 2018-19



*S. M. George*  
PRINCIPAL  
ST. MARY'S COLLEGE  
SULTHAN BATHERY  
WAYANAD-673 592

## **PROGRAMME SPECIFIC OUT COME (BSc CHEMISTRY)**

- To understand the basic concepts in chemistry
- To understand the applications of chemistry in day-to-day life
- To value the history of achievements in chemistry
- To know the role of chemistry in society
- To explore the emerging areas in chemistry and understand its relevance in future.
- To develop laboratory skills for safe handling of chemicals and instruments.
- To understand and explore chemistry in various industries.
- To create environmental awareness in students.

## **CHEMISTRY (Course Outcome-UG)**

### **Semester I (CHE1B01 Core Course I: Theoretical and Inorganic Chemistry-I)**

- Remember the evolution of chemistry as a discipline of science
- Understand the basics concepts of chemistry and fundamental principles of analytical chemistry.
- Analyze the features and limitations of various models of atomic structure.
- Understanding the basic aspects of nuclear chemistry.

### **Semester II (CHE2B02Core Course II: Theoretical and Inorganic chemistry II)**

- To understand the basic concepts of quantum chemistry and quantum numbers
- To distinguish various orbitals and their shapes
- To solve SWE
- To apply SWE to one electron atoms and multi electron atoms
- To know more about modern periodic table
- To compare various properties of elements in the modern periodic table
- To distinguish between various types of bonds
- To understand and compare various theories on bonding in molecules
- To predict the structure of various molecules based on theories
- To familiarize the various intermolecular forces existing in molecules

### **Semester III(CHE3BO3 Core Course III: Physical chemistry - I)**

- understand the properties of gases, gas laws, deviation of real gases from gas laws
- understand the basics of thermodynamics,

- Detailed study of the laws of thermodynamics
- understand the concept of thermochemistry
- Understand the concept of statistical thermodynamics
- Understand the properties of liquids
- Basic concepts of chemical equilibria, Lechatelier principle and its applications

#### **Semester IV** (CHE4B04 Core Course IV: Organic Chemistry-I)

- Understand the classification and nomenclature of organic compounds.
- Describe aromaticity and stereochemistry of organic compounds
- Understand basics of organic reaction mechanisms.
- Compare aspects of substitution and addition reactions

#### **Semester V** (CHE5B06 Core Course VI: Inorganic Chemistry-III)

- Explain the chemistry of s and p block elements.
- Understanding qualitative and quantitative analysis techniques
- Understanding the structure and applications of inorganic polymers and non aqueous solvents
- Describe ecosystems and environmental pollution.
- Analyze social issues related to the environment.

#### **Semester V** (CHE5B07 Core Course VI: Organic Chemistry-II)

- To understand and recall the nomenclature classification and isomerism in Alkyl halides, hydroxy compounds, aldehydes and ketones ethers and epoxides, carboxylic acids, Nitrogen compounds and Heterocycles and active methylene compounds.
- To familiarize and learn the various methods of preparation and chemical properties of Alkyl halides, alcohols, aldehydes and ketones, ethers and epoxides, carboxylic acids, Nitrogen compounds and Heterocycles and active methylene compounds.
- To distinguish between elimination and nucleophilic substitution reactions in RX
- To have an indepth knowledge on Grignard reagents, Its preparation and properties
- To compare the acidity of alcohols, phenols, carboxylic acids and sulphonic acids.
- To compare the basicity of aliphatic and aromatic amines
- To learn different name reactions
- To know the various applications of sulpha compounds in day-to-day life.
- To learn the structural formulae of various sulpha drugs
- To learn the synthetic applications of active methylene compounds
- CHE5B07 Core Course VII: Organic Chemistry-II

#### **Semester V** (CHE5B08 Core Course VIII: Physical Chemistry-II)

- Acquire knowledge of Steady state approximation and theories of reaction rates
- Understand of the theories for the determination of the rate of the reactions
- Students will acquire a good knowledge on the chemical kinetics, unimolecular and bimolecular reactions, Catalysis, Surface chemical reactions
- Understand the features of homogeneous catalysis–Enzyme catalysis
- Understand the Gibbs phase rule and its derivation and its application
- Students will acquire a good knowledge on the spectroscopy of molecules like IR, NMR, UV etc.
- Understand the features of homogeneous catalysis–Enzyme catalysis
- Laws of photochemistry, Jablonski diagram and Quantum yield

### **Semester VI (CHE6B09 Core Course IX: Inorganic Chemistry-IV)**

- Explain the chemistry of d and f block elements.
- Describe the properties and applications of coordination compounds.
- Explain the structure and properties of organometallic compounds, metal carbonyls and metal clusters
- Explain the importance of bioinorganic chemistry.

### **Semester VI (CHE6B10 Core Course X: Organic Chemistry-III)**

- Structure Elucidation Using Spectral Data: A detailed study of rotational, vibrational and electronic levels, IR Spectroscopy, UV-Visible Spectroscopy and NMR Spectroscopy.
- Carbohydrates: Detailed study of certain biomolecules.
- Proteins: Detailed study of proteins.
- Lipids, Steroids, Vitamins & Hormones: Detailed study of Lipids, Steroids, Vitamins &
- Hormones.
- Nucleic acids, Alkaloids and Terpenes: Detailed study of Nucleic acids, Alkaloids and
- Terpenes.

### **Semester VI (CHE6B11 Core Course XI: Physical Chemistry-III)**

- Acquire knowledge on Fundamentals of Electrochemistry, Ostwald's dilution law and its applications.
- know the Types of cell and electrodes, Nernst equation for electrode potential, Concentration cells and Potentiometric titrations
- Understand the detail chemistry Solubility of gases in liquids, Colligative properties and Determination of molecular mass using colligative properties
- Learn about Abnormal molecular mass – Van't Hoff factor.
- Understand the Mechanism of buffer action – Buffer index and Solubility product and common ion effect.
- Understand the basics of types of solids, defects in crystals, types of conductivity in solids and different types of close packing in crystals.

## **Semester VI (CHE6B12 Core Course XII: Advanced and Applied Chemistry)**

- To understand basic facts and concepts in chemistry.
- To develop the ability for applying the principles of chemistry.
- To appreciate the achievements in chemistry and to know the role of chemistry in nature and in society.
- To familiarize the emerging areas of chemistry and their applications in various spheres of chemical sciences and to apprise the students of its relevance in future studies.
- To develop skills in the proper handling of instruments and chemicals.
- To be exposed to the different processes used in industries and their applications.
- To make the students eco-friendly by creating a sense of environmental awareness in them.
- To make the students aware of the applications of chemistry in day-to-day life.

## **Semester VI (CHE6B13(E2) Core course Elective. Polymer chemistry)**

- Understand the basics of polymer chemistry and its classification
- Understand different types of polymerization
- Understand the properties and reactions of polymers
- Understand the techniques of polymerization and processing
- Detailed study of different commercial polymers
- Understand the applications of polymers

## **PRACTICALS**

### **CHE4B05(P) Core Course V: Inorganic Chemistry Practical-I**

- Estimate the amount of substance in a given solution by acidimetry, alkalimetry, complexometry, permanganometry, dichrometry, iodimetry and iodometry.
- Apply microscale procedures like two-burette titration in acidimetry and alkalimetry.

### **CHE6B14(P) Core Course XIV: Physical Chemistry Practical**

- Understand the principles of physical chemistry through experiments.
- Acquire expertise in Refractometry, Conductometry, Potentiometry, pH metry and Kinetics.

### **CHE6B15(P) Core Course XV: Organic Chemistry Practical**

- Identify and distinguish various organic compounds
- Understand the preparation of organic compounds.

### **CHE6B16(P) Core Course XVI: Inorganic Chemistry Practical-II**

- Estimate the amount of a substance by gravimetric analysis.

- Acquire expertise in precipitation, filtration, incineration and drying.

### **CHE6B17(P) Core Course XVII: Inorganic Chemistry Practical-III**

- Explain the reactions of various cations and anions in a mixture.
- Acquire expertise in inorganic preparation.

## **COMPLEMENTARY CHEMISTRY**

### **Complementary Course I: CHE1C01 General Chemistry**

- Students will acquire a good knowledge on Atomic Structure and Chemical Bonding
- Understand of the theories of volumetric analysis
- Understand the principles in the separation of cations in qualitative analysis
- Students will acquire a good knowledge on the Methods of expressing concentration
- Understand the features of nuclear reactors, atom bomb, hydrogen bomb and several applications of radioactivity
- Understand the methods of transition of blood in human body, importance of metals ions in biological systems and structure and mechanism of action of sodium potassium pump

### **Complementary Course II: CHE2C02 Physical Chemistry**

- Definition of thermodynamic terms, The concept of Gibbs free energy, Entropy and Third law of Thermodynamics.
- know the Kinetic molecular model of gases – Maxwell distribution of velocities and its use in calculating molecular velocities, Ideal gas equation – Behaviour of real gases – Deviation from ideal behavior
- Understand the detail chemistry Solubility of gases in liquids, Colligative properties and Determination of molecular mass using colligative properties
- Learn the advance chemistry of electrochemistry
- understand the Specific conductance, Galvanic cells - Cell and electrode potentials and Ostwald's dilution law
- Understand the basics of types of solids, defects in crystals, types of conductivity in solids and different types of close packing in crystals.

### **Complementary Course III: CHE3C03 Organic Chemistry**

- Students can understand the basic concepts of organic reaction mechanisms.
- Students can understand some basic information in Stereochemistry.
- Students can get some basic knowledge in aromaticity.
- understand the basic concepts of organic reaction mechanisms and their applications.
- Study of certain biomolecules.

### **Complementary Course IV: CHE4C04 Physical and Applied Chemistry**

- Students can understand certain properties and applications of colloids.
- Detailed study of the rate of reactions of different orders.
- Study of different types of catalysis.
- General study of different chromatographic techniques.

- A study of rotational, vibrational and electronic levels, IR Spectroscopy, UV-Visible Spectroscopy and NMR Spectroscopy.
- Understand the basics of polymer chemistry and its classification and the study of different commercial polymers
- Study of types of pollution. Study of types certain water quality parameters.
- study of many chemical compounds used in our daily life.

## **PRACTICALS**

### **Complementary Course V:CHE4C05(P) Chemistry Practical**

- Estimate the amount of substance in a given solution by acidimetry, alkalimetry, complexometry, permanganometry, dichrometry, iodimetry and iodometry.
- Apply microscale procedures like two-burette titration in acidimetry and alkalimetry.
- Distinguish various cations in a mixture.

## **B.Sc. Chemistry V Sem Open Course**

### **CHE5D01 Open Course 1: Environmental Chemistry**

- Recall the technical/scientific terms involved in pollution.
- Understand the causes and effects of air pollution.
- Understand the sources, types and effects of water pollution.
- Describe water quality parameters.
- Know soil, noise, thermal and radioactive pollutions and their effects.
- Study various pollution control measures.
- Understand the basics of green chemistry.

## **PROGRAMME SPECIFIC OUT COME (MSc CHEMISTRY)**

- Demonstrate an in-depth knowledge and understanding of the principles of Inorganic, Organic, Physical and Theoretical Chemistry.
- Demonstrate an awareness of the relevance of chemistry in a wider multidisciplinary context. Intellectual Abilities.
- Apply their understanding in Chemistry to design solutions to unfamiliar problems in Chemistry and those involving other related disciplines.
- Use their knowledge and understanding to conceptualize appropriate models and representations. Practical Skills
- Design and conduct analytical, modelling and experimental investigations in Inorganic, Organic, Physical and Theoretical Chemistry. Professional Skills

- Ability to identify, design and conduct appropriate experiments, interpret data obtained, draw pertinent conclusions and communicate all these effectively.

## **CHEMISTRY (Course Outcome-PG)**

### **Semester I(CH1CO1 Basic concepts in quantum chemistry and group Theory)**

- To give an understanding of basic principles of quantum mechanics and their applications to study the internal structure of atoms and molecules.
- To provide an introduction to the mathematical foundations of quantum chemistry.
- To solve the schrodinger equation for standard system with both analytical and numerical methods and then interpret the result.
- To use commutation relation to explain the outcome of measurements.
- To enable students to work independently with key questions and problems in quantum mechanics.
- To allow an understanding of the important concepts of group theory.
- To obtain proficiency in the study of symmetries of physical systems, and the use of groups to classify and quantify natural phenomenon.

### **Semester I(CH1CO2 Elementary inorganic chemistry)**

- Understanding molecular structure and bonding
- Explain the chemistry of acids, bases, non-aqueous solvents and metal-organic frameworks.
- Developing a deep knowledge about the chemistry of main group elements

### **Semester I(CH1CO3 Structure and reactivity of organic compounds)**

- Explain the basic concepts of organic chemistry.
- Illustrate the principles of physical organic chemistry.
- Demonstrate the reactivity and stability of organic molecules based on structure, including conformation and stereochemistry.

### **Semester I(CH1CO4 Thermodynamics, kinetics and catalysis)**

- Represent of the rate law of the elementary and chain reaction
- Understand of the theories for the determination of the rate of the reactions
- Understand of the kinetics of the explosive photochemical and unimolecular reactions
- Understand of the laws of thermodynamics and their applications



- Students will acquire a good knowledge on the chemical kinetics, unimolecular and bimolecular reactions, fast reactions, Catalysis, Surface chemical reactions and Photochemistry of atoms and molecules
- Understand the features of homogeneous catalysis–Enzyme catalysis
- Understand the methods of preparation of heterogeneous catalysts

### **Semester II**(CH2CO5 Applications of quantum mechanics and group theory)

- Able to visualize molecule in 3-D, understand the concept of symmetry elements and symmetry operations.
- know the point groups of molecules and understand symmetry considerations for optical activity and dipole moment.
- Understand the group multiplication table, character table and representations of group.
- Apply the projection operator for constructing SALCs.
- correlate application of symmetry to spectroscopy and find IR active modes of vibration.
- Understand the detail chemistry of s- and p- block elements w.r.t. their compounds, reactions and applications.
- learn the advance chemistry of VB theory and Molecular Orbital (MO) theory
- understand how to derive the SALCs for molecules using the Projection Operators and also how to construct molecular orbitals using various symmetry operations and their representations
- Understand the applications of quantum mechanical treatment to hybridization
- Understand the Hückel Molecular Orbital (HMO) theory of ethylene, butadiene & allylic anion

### **Semester II** (CH2CO6 Coordination chemistry)

- Understand the structural and bonding aspects of co-ordination compounds.
- Explain the thermodynamic and kinetic aspects of reactions of metal complexes
- Understanding reaction mechanism of complexes.
- Explain the spectral properties, magnetic properties and characterization of metal complexes.
- Understanding the redox and photochemical reactions of complexes.

### **Semester II**(CH2CO7 Organic reaction mechanisms)

- Detailed study of substitution reaction mechanism.
- Detailed study of Addition and Elimination Reaction Mechanisms.

- Detailed study of carbonyl compounds.
- Detailed study of FMOs of certain conjugated systems and their reactions. Study of different types of pericyclic reactions.
- Photochemistry of Organic Compounds: Detailed study of certain photochemical reactions.
- Chemistry of Natural Products: Detailed study of certain natural products.

### **Semester II (CH2CO8 Electrochemistry, solid state chemistry and Statistical Thermodynamics)**

- Find the connection between statistics and thermodynamics.
- Difference between different ensemble theories used to explain the behaviour of the system
- Differentiate between classical statistics and quantum statistics.
- Explain the statistical behaviour of ideal Bose and Fermi systems.
- Learn the advance chemistry of electrochemistry.
- Understand the specific conductance, Galvanic cells-cell and electrode potentials and Ostwald's dilution law.
- Understand the basics of types of solids, defects in crystals, types of conductivity in solids and different types of close packing in crystals.

### **Semester III (CH3CO9 Molecular spectroscopy)**

- Understand the concept of microwave spectroscopy
- Understand the basics of IR, Raman and Electronic spectroscopy
- Detailed study of NMR spectroscopy, NOE, FT NMR and 2D NMR
- Detailed study of electronic and vibrational spectroscopy, ORD and CD
- Detailed study of the application of NMR spectroscopy in organic chemistry
- Detailed study of Mass spectroscopy and its application for structure elucidation

### **Semester III (CH3C10 Organometallic & Bioinorganic chemistry)**

- To have a deeper understanding of organometallic compounds, its synthesis and applications
- To learn various applications of organometallic compounds in catalysis
- To focus more on metal clusters and its bonding and properties
- To familiarize the role of organometallic compounds in bioinorganic chemistry
- To understand the mechanism of various biological processes involving organometallic compounds.

### **Semester III (CH3C11 Organic transformations and reagents)**

- Detailed study of certain oxidation reactions.

- Detailed study of certain reduction reactions.
- Detailed study of certain synthetically important reagents.
- Detailed study of polymer chemistry.
- Detailed study of certain heterocyclic compounds.
- Detailed study of certain rearrangement reactions.

### **Semester III (CH3EO3 Green and Nanochemistry(Elective))**

- Introducing principles and tools of green chemistry.
- Illustrate the microwave mediated organic synthesis, alternative synthesis, reagents and reaction conditions.
- Describing the synthetic methods and characterization techniques of nanomaterials.
- Understanding carbon clusters and nanostructures.

### **Semester IV(CH4C12 Advanced Topics in Chemistry)**

- Developing a deep knowledge about nano materials, their characterization and applications.
- Understanding the principles of supramolecular and green chemistry
- Explain the mechanism of drug action and drug designing.
- Understanding the basic principles of computational quantum chemistry
- To develop an understanding about industrial catalysis.

### **Semester IV(CH4C13 Instrumental Methods of Analysis)**

- Understanding errors in chemical analysis and conventional analytical procedures
- Apply various electro-analytical techniques in qualitative and quantitative analysis.
- Developing an idea about various optical, thermal and radiochemical methods of characterization.

### **Semester IV (CH4EO6 Natural Products & Polymers (Elective))**

- Describing the structure and synthesis of natural products.
- A brief introduction to dyes, pigments and supramolecules.
- Detailed study of polymerization processes, characterization and stereochemistry of polymers
- Understanding polymer solutions, industrial polymers and copolymers.
- Explaining the chemistry of advanced polymeric materials.

## **PRACTICALS**

### **Semester I& II (CH1PO1 Inorganic chemistry practical I&CH2PO4 Practical II)**

- Separate and identify four metal ions of which two are less familiar elements by systematic procedure.
- Students will be able to do **Colorimetric Analysis**
- Volumetric Determinations using:
  - EDTA (Al, Ba, Ca, Cu, Fe, Ni, Co, hardness of water)
  - Cerimetry ( $\text{Fe}^{2+}$ , nitrite)
  - Potassium Iodate (Iodide,  $\text{Sn}^{2+}$ )
- Students will be able to do **Colorimetric Analysis**
  - Colorimetric Determinations of metal ions Fe, Cr, Ni, Mn, and Ti.

### **Semester I& II(CH1PO2 Organic chemistry Practical I&CH2PO5 Practical II)**

- Carry out different methods of separation and purification of organic compounds.
- Apply the methods of separation and purification to organic binary mixtures
- Carrying out organic preparations of double stage and three stage

### **Semester I& II (CH1PO3 Physical chemistry practical&CH2PO6 Practical II)**

- Study of the determination of molar heat of solution of a substance of phase diagram of a simple eutectic system.
- Determination of molecular weight of a polymer.
- Determination of distribution coefficient and determination of concentration of KI solution.
- Determination of the composition of liquid mixtures.
- Determination of equivalent conductance.
- Potentiometric titration.

### **Semester III& IV (CH3PO7 Inorganic chemistry practical III&CH4P10 Practical IV)**

- To focus more on accuracy and precision
- To develop skills on separating mixtures
- To determine the concentration of some cations quantitatively using volumetric and colorimetric experiments.
- To develop observation skills.

### **Semester III& IV (CH3PO8 Organic chemistry practical III&CH4P11 Practical IV)**

- Understand the estimation methods of several compounds, chromatographic techniques, thin layer and paper chromatography

### **Semester III & IV (CH3PO9 Physical chemistry practical III&CH4P12 Practical IV)**

- Carry out experiments related to chemical kinetics, Phase equilibrium, Cryoscopy, polarimetry, adsorption and CST
- Apply the methods of computational chemistry to solve different problems of chemistry