Sophia College (Autonomous)

Chemistry

FYBSC

Semester I

Paper I

Course Code SBSCHE101

Learning objectives

- To understand the fundamental concepts of thermodynamics and relationship among thermodynamic parameters.
- To understand the calculations involved in preparation of solutions of different concentrations.
- To clarify the basics of atomic structure using quantum mechanics: shapes of orbital
- To understand the special features of the quantum mechanical model of an atom and to define an atomic orbital in terms of its quantum numbers
- To correlate the chemical properties of elements with their position in the periodic table
- To understand the method of naming organic compounds systematically.
- To understand the bonding and geometry of different organic compounds
- To understand the fundamental concepts of organic chemistry and its effect on acidity, basicity, reactivity of organic compounds.

Learning outcomes:

The learner will be able to

- derive relationship between different thermodynamic variables and solve numericals based on data given
- calculate amounts of solutes required for preparation of different solutions.
- explain the concepts of nodes and the shapes of the orbital with correct signs of wave functions.

- explain experimental observables by using the quantum mechanical model studied
- capable of discerning the chemical properties of elements based on parameters with predictable trends across periods and groups in periodic table
- identify the various functional groups and name them using IUPAC nomenclature
- predict the acidity, basicity and reactivity of organic compounds.

Paper II

Course Code SBSCHE102

Learning outcomes

- To understand the fundamental concepts of chemical kinetics.
- To recognise different properties of liquid states and instruments for their measurement.
- To understand the properties of main group elements
- To understand the terminology, nomenclature and basic concepts related to stereochemistry.
- To acquaint with the various projections used and conformational analysis of organic molecules
- To understand the method of assigning configuration to chiral compounds with and without a stereogenic centre

Learning objectives:

Learner will be able to

- interpret data obtained from various kinetic reactions and identify order of reaction
- calculate the values of various properties exhibited by liquids from experimental data
- write and compare properties of main group elements.
- distinguish between the different types of stereoisomers.
- assign configuration to compounds and correlate between the structure and configuration of stereoisomers and the chemical and biological properties

Sophia College (Autonomous)

Semester II

Paper I

Course Code SBSCHE201

Learning objectives

- To understand different laws applicable to gases
- To understand various concepts of chemical equilibrium and Le Chatelier's principle
- To introduce to catalysis and different types of catalyst
- To apply the concept of the solubility product and pH of the medium on precipitation of ionic compounds
- To study different acid-base theories
- To learn various methods of preparation of hydrocarbons
- To understand the mechanism of reactions of hydrocarbons.

Learning outcomes:

Learner will be able to

- solve numericals based on gas laws
- apply Le Chatelier's principle and identify different parameters required for optimization of chemical reaction
- understand the experimental observations in the laboratory in semi-micro analysis with the concept of solubility product
- compare the different acid-base theories
- identify different types of catalyst and explain the mechanism of action
- write various preparative methods and predict the mechanisms of hydrocarbon

Sophia College (Autonomous)

Paper II

Course Code SBSCHE202

Learning objectives

- To understand concept of ionic equilibria, pH and buffers
- To understand basic terms in spectroscopy and laws of visible spectroscopy
- To learn different types of chemical bonds and factors affecting their reactivity
- To study redox chemistry with respect to electrochemical reactions
- To understand the stereochemistry of cycloalkanes and aromatic hydrocarbons and their relative stability
- To understand the criteria of aromaticity
- To understand mechanism of reactions of aromatic hydrocarbons

Learning outcomes:

Learner will be able to

- calculate equilibrium constants and pH of aqueous solution and buffer
- identify and compare different types of spectroscopy and solve numerical based on Beer Lambert's law
- explain the bonding and factors affecting chemical bonds in inorganic molecules
- predict the outcome of redox reactions based on the electrochemical series
- explain the stereochemistry of cycloalkanes and predict the strain experienced by the compound.
- classify the organic compounds as aromatic and antiaromatic compounds
- predict the mechanisms for aromatic compounds

Sophia College (Autonomous)

CHEMISTRY PRACTICALS

Semester I

Course Code: SBSCHEP1

Learning Objectives:

- To prepare standard solutions for volumetric analysis
- To learn to carry out chemical kinetics in the laboratory
- To introduce volumetric and gravimetric methods of analysis
- To understand steps in characterization of organic compounds

Learning Outcomes:

The learner will be able to

- prepare standard solutions of exact normality
- perform chemical kinetics and predict order of reaction from the data
- carry out analysis using volumetric and gravimetric methods
- characterize organic compounds

Sophia College (Autonomous)

Semester II

Course Code: SBSCHEP2

Learning Objectives:

- To learn the use of pH meter and colorimeter
- To learn the standardisation of commercial samples of acids and bases
- To carry out qualitative analysis of inorganic salts
- To study the use of chromatography as a tool of separation and identification
- To learn to recrystallise organic solids

Learning Outcomes:

Learner will be able to

- use pH meter and colorimeter for analysis of compounds
- successfully standardize commercial samples of acids and bases
- analyze and identify ions of mixture of inorganic salts
- carry out TLC of mixture of organic compounds
- be able to purify organic solids by using suitable recrystallization solvents

Sophia College (Autonomous)

SYBSC

PAPER I - Physical and Analytical Chemistry

Course Code: SBSCHE301

Learning Objectives:

- To understand and enumerate the concept of entropy, free energy functions, its variation with temperature and pressure, partial molal properties,
- To emanate the significance of Van't Hoff Reaction Isotherm & Isochore.
- To identify and classify chemical reactions with respect to kinetics identify techniques for fast reactions, the effect of temperature on rate and theories of reaction rate
- To introduce the relevance and importance of analytical chemistry

Learning Outcomes:

The learner will be able to

- understand the different thermodynamic parameters such as entropy, helmholtz free energy, gibbs free energy changes and its significance
- Solve numericals on Gibbs Helmholtz equation, Gibbs-Duhem equation, Van't Hoff Reaction isotherm and isochore.
- understand and extrapolate Raoult's law, deviation of Raoult's law, composition curves, Azeotropes and methods of separating them
- identify and classify the sources of error, calculate accuracy and precision of a method from the given data, and apply significant figures rules accurately.

Sophia College (Autonomous)

PRACTICALS

SEMESTER III

PHYSICAL AND ANALYTICAL CHEMISTRY

Learning Objectives:

- To learn applications of different concepts, methods and techniques learnt in theory to various chemical reactions/systems.
- To prove various laws and equations using different instrumental methods.

Learning Outcomes:

The learner will be able to

- analyze various compounds by using classical and instrumental methods of analysis
- able to prove or verify laws/equations through simple experiments
- calculate rate and order of the reaction for known chemical systems

Sophia College (Autonomous)

SEMESTER IV

Paper I- Physical and Analytical Chemistry

Course Code: SBSCHE401

Learning Objectives:

- To understand and extrapolate phase rule, phase diagrams and its application
- To solve numericals based on cell emf using Nernst equation
- To understand and restate the laws of crystallography, symmetry elements, bravais lattice types and use of x-rays in crystal structure determination.
- To understand the theory behind major categories of instrumental methods of analysis.

Learning Outcome:

The learner will be able to

- understand phase rule thermodynamically
- identify different types of electrodes, write the electrode reactions, explain the principle,construction and working of calomel, glass electrodes.
- discuss and emanate catalysis, properties and types of catalyst, reactions with nanoparticles as catalyst and to derive the Michaelis-Menten equation.
- compare and contrast different instrumental methods of analysis

PRACTICALS

SEMESTER IV

PHYSICAL AND ANALYTICAL CHEMISTRY

Learning Objectives:

- To understand applications of various instrumental methods to various systems
- To evaluate simulated data
- To understand and perform experiments based on optical methods

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Learning Outcomes:

The learner will be able to

- Generate data to find out rate and order of reaction
- use potentiometry for analysis of various compounds and to construct an electrochemical cell
- analyze commercial samples by optical methods at very low concentration

SEMESTER III

PAPER II - Inorganic And Applied Inorganic Chemistry

Course Code: SBSCHE302

Learning Objectives:

- To understand the bonding fundamentals for both ionic and covalent compounds, including electronegativities, bond distances and bond energies using MO diagrams and thermodynamic data
- To predict geometries of simple molecules
- To understand the fundamentals of the chemistry of the main group elements, and important real world applications of many of these species
- To introduce the importance of environmental chemistry, components of atmosphere and biogeochemical cycles
- To get a knowledge of different types of pollution with reference to source and control measures

Learning Outcomes:

The learner will be able to

- differentiate between ionic and covalent compounds, and explain their properties using different theories
- predict and understand geometries of different covalent compounds
- identify and analyze different properties of main group elements
- understand interdependence of biotic and abiotic components
- identify and classify sources of pollutants
- analyze the man made disasters from a chemistry point of view

Sophia College (Autonomous)

PRACTICALS

SEMESTER III

INORGANIC AND APPLIED INORGANIC

Learning objectives:

- to identify different anions and cations present in a mixture
- to determine the amount of elements present in a given solution gravimetrically
- to determine the amount of elements present in a given solution complexometrically

Learning outcomes:

The learner will be able to

- identify and analyze ions present in a given mixture by semi-micro inorganic qualitative analysis.
- analyze and report the amount of elements present by doing gravimetric analysis.
- analyze and report the amount of elements present in a given solution by using complexometric reactions.

SEMESTER IV

PAPER II - Inorganic And Applied Inorganic Chemistry

Course Code: SBSCHE402

Learning Objectives:

- To gain understanding of transition metal ions and their properties
- To build knowledge on coordination complexes and their application in bioinorganic chemistry
- To introduce the quality parameters of water
- To learn various metallurgical operations
- To learn about the importance and steps in the treatment of effluent
- To learn about corrosion and its control measure

Learning Outcomes:

The learner will be able to

- identify and list different transition metal ions and their properties
- understand bonding in coordination complexes, naming of coordination compounds and explain their magnetic properties
- write and perform analysis of water to assess its quality
- understand different stages in the process of metallurgy and the chemical reactions involved
- to understand the importance of various steps in the effluent treatment plant
- identify the factors responsible for corrosion and to suggest appropriate methods for the prevention

PRACTICALS

SEMESTER IV

INORGANIC AND APPLIED INORGANIC CHEMISTRY

Learning objectives:

- to determine the amount of ions present in a given solution gravimetrically
- to determine the amount of ions present in a given solution complexometrically

Learning outcomes:

The learner will be able to

- report the amount of ions present by doing gravimetric analysis
- report the amount of ions present in given solution by using complexation reaction

Sophia College (Autonomous)

Semester III

Paper III- Organic And Applied Organic

Chemistry Course Code: SBSCHE303

Learning Objectives:

- To understand various ways of determining the reaction mechanism
- Learn aliphatic compounds with respect to ○ physical properties, preparations, reactions and mechanism of selected reactions
- To understand and gain knowledge about the importance and need of green chemistry

Learning Outcomes:

Learner will be able to

- predict and write the mechanism of a reaction under given conditions
- Predict the product for given reactions
- interconvert functional groups
- identify and arrange the given compounds as per acidity and basicity.
- elaborate the applications of Green Chemistry in current industrial scenario

Practical

Semester III

ORGANIC AND APPLIED ORGANIC CHEMISTRY

Learning Objectives:

- learn to prepare derivatives of a given functional group
- understand and restate the Green Chemistry principles involved in green reactions

Learning Outcomes:

Learner will be able to

- identify the compound based on their functional group derivatives
- prepare organic compounds based on green chemistry principles.

Sophia College (Autonomous)

Semester IV

Paper III - Organic and Applied Organic Chemistry

Course Code: SBSCHE403

Learning Objectives:

- Learn the method of naming aromatic compounds
- Gain understanding of various ways of determining the reaction mechanism
- Learn aromatic compounds with respect to physical properties, preparations, reactions and ○ mechanism of selected reactions
- Understand various industrial procedures involved in production of fuel from crude oil

Learning Outcomes: Learners will be able to

- predict and write the mechanism of a reaction under given conditions
- Predict the product for given reactions
- interconvert functional groups using sulphonic acid derivatives
- identify and arrange the given compounds as per acidity and basicity.
- Write the name/draw structure of a given organic compound

Practical

Semester IV

ORGANIC AND APPLIED ORGANIC CHEMISTRY

Learning Objectives:

- Qualitatively analyze the given mono and bifunctional organic compounds using microtechniques.
- analysis of given organic compounds based on functional group specific reactions

Sophia College (Autonomous)

Learning Outcomes:

Learners will be able to

- identify the given mono and bifunctional organic compound
- estimate the amount of organic compound present in the given sample using suitable method

Systematic Qualitative Analysis of organic compounds with mono and bifunctional groups. (acidic, phenolic,alcoholic,aldehydic, ketonic, amide, nitro, amines, esters, hydrocarbons,thioamides etc.). Minimum of 6 compounds Organic Estimation Estimation of equivalent weight of acid. Estimation of acetamide. Estimation of acetone. Estimation of aniline.

PHYSICAL CHEMISTRY

SEMESTER V

COURSE CODE: SBSCHE501

Learning Objectives:

- To understand different types of spectroscopy - rotational, vibrational and raman spectroscopy and numericals based on them
- To study different types of adsorption isotherms, properties of colloidal solutions and applications of surfactants
- To study different transmutation reactions, applications of radioisotopes, fission and fusion processes and to calculate the Q-values
- To study the influence of ionic strength, hydrostatic pressure, dielectric constant and effect of substituents on the rate of reactions

Learner's Outcome:

Learner will be able to

- solve numericals based on energy levels, wavenumbers and raman spectra
- determine the surface area of an adsorbent using B.E.T. equation
- explain the electrical properties of colloids,micellization and classify surfactants
- calculate the Q-values,explain the nuclear reactor,fissile material and applications of radioisotopes as tracers
- understand and apply the Hammet equation, also comment on how ionic strength affects the rate of reactions using numericals

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PRACTICALS

Learning Objectives:

- To train the students to handle different instruments and maintain laboratory discipline
- To carry out the experiments mentioned in the course and thereby be able to correlate the importance of the theory with the practical experiments

Learning Outcome:

Learner will be able to

- understand the handling of instruments and correlate practical experiments with theoretical knowledge
- set up different electrochemical cells
- practice laboratory safety measures and precautions to be taken while handling the instrument, electrodes and different

PRACTICALS

Learning Objectives:

- To train the students to handle different instruments and maintain laboratory discipline
- To carry out the experiments mentioned in the course and thereby be able to correlate the importance of the theory with the practical experiments
- To interpret information from the graphs plotted

Learning Outcome:

Learner will be able to

- understand the handling of instruments and correlate practical experiments with theoretical knowledge 24
- set up different types of electrochemical cells
- practice laboratory safety measures and precautions to be taken while handling the instrument, electrodes and chemicals

Sophia College (Autonomous)

INORGANIC CHEMISTRY

SEMESTER V

COURSE CODE: SBSCHE502

Learning objectives

- To expose students to the concept of symmetry and symmetry elements
- To understand structure of crystalline solids and defects
- To learn the preparation and properties of superconductors and nanomaterials
- To familiarize with chemistry of inner transition elements

Learning outcomes:

Learner will be able to

- interpret the symmetry of simple inorganic molecules and assign appropriate point groups
- classify crystalline solids based on structures
- write synthesis, properties and application of superconductors and nanomaterials
- compare properties of inner transition elements and transition elements

PRACTICALS

Learning objectives

- To train students to prepare simple inorganic complexes, silver nanoparticles and to analyze given inorganic complexes
- to analysis metal ions from variety of samples by complexometry
- to train students to perform titrimetric analysis under non-aqueous conditions

Learning outcomes:

The learner will be able to

- prepare and analyze simple inorganic complexes
- prepare and characterize silver nanoparticles using UV spectrophotometer
- estimate metal ions from an unknown sample with high degree of accuracy complexometrically
- carry assay of given drug samples by non-aqueous titrations

Sophia College (Autonomous)

SEMESTER VI

COURSE CODE: SBSCHE602

Learning objectives

- To build basic concepts of coordination chemistry using crystal field and molecular orbital theory
- To introduce basic concepts of inorganic spectroscopy
- To understand methods of preparation and reactions of organometallic compounds of main group elements
- To understand properties of group 17 &18 elements and to learn preparation of interhalogen and pseudohalogens

Learning outcomes:

Learner will be able to

- calculate crystal field energies of given molecules
- construct molecular orbital diagrams for coordination complexes
- calculate ground term symbols for simple inorganic molecules
- write general methods of preparations and reactions of organometallic compounds of main group elements
- compare and contrast properties of group 17&18
- write synthesis and assign structures to interhalogens and pseudohalogens

PRACTICALS

Learning objectives

- To prepare ,characterize and estimate inorganic complexes
- To learn to perform complexometric titrations for given metal ions
- To estimate chlorine from a commercial sample

Learning outcomes:

The learner will be able to

- synthesis ,analyze and calculate crystal field stabilization energy of inorganic complexes
- estimate metal ions from a given sample complexometrically
- analyze commercial sample for chlorine content by redox titration

Sophia College (Autonomous)

ORGANIC CHEMISTRY

SEMESTER V

COURSE CODE: SBSCHE503

Learning Objectives:

To Understand the

- Mechanisms of reactions and name reactions
- Method of naming organic compounds
- Stereochemistry of compounds without stereogenic center and cycloalkanes
- Catalysts and reagents involved in reactions
- Natural products and their structure determination and synthesis
- Basic principles of photochemistry and some of the reactions
- Preparation and mechanism of reactions of organometallic compounds

Learning Outcomes:

Learner will be able

- To identify the mechanism of reactions studied with different substrates
- Apply various catalysts and reagents for interconversion of functional groups
- Identify the optical activity of molecules without stereogenic center and stereospecific and stereoselective reactions
- Understand the application of polymers in day to day life
- Elucidate the structural determination of some natural products

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PRACTICALS

24 Organic Separation Separation of a binary mixture - Type of mixture, Separation and identification (microscale) of one of the components through systematic scheme of identification. Type: Solid + Solid (no carbohydrates to be given) Mass of solid: 3 g

Learning objective:

- To understand the method and concept of separation of a binary mixture quantitatively
- To train the learners to perform qualitative analysis and identify a component
- To understand the method of purification of the components.
- To develop the skill of determining physical constant of compounds

Learning outcomes:

- Learners will be able to identify the nature of a binary mixture and separate the mixture quantitatively.
- To enable the students to develop skills in organic qualitative analysis
- To enable students to purify compounds by recrystallization technique

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SEMESTER VI

COURSE CODE: SBSCHE603

Learning Objectives:

Learner will understand the basic principles of

- Molecular spectroscopy
- stereochemical reactions
- Biomolecules
- polymers and polymerisation
- Heterocyclic compounds of one heteroatom

Learning Outcome:

Learner will be able to:

- interpret spectral data in identification of various organic molecules
- identify stereospecific and stereoselective reactions
- Convert open chain and Haworth structures of carbohydrates.
- identify the mono, di and polysaccharides

PRACTICALS

Learning objective:

- To understand the method and concept of separation of a binary mixture quantitatively by physical method
- To train the learners to perform qualitative analysis and identify a component
- To understand the method of purification of the components.
- To develop the skill of determining physical constant of compounds
- To help learners to prepare synthetically useful organic compounds.
- To acquaint learners with chromatographic techniques
- To interpret spectrum

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Learning outcomes:

- Learners will be able to identity the nature of a binary mixture and separate the mixture quantitatively.
- To enable the students to develop skills in organic qualitative analysis 24
- To enable students to purify compounds by distilling technique
- To prepare organic compounds and understand the course of the reaction with the help of TLC
- To elucidate the structure of a compound based on the spectral data

ANALYTICAL CHEMISTRY

SEMESTER V

COURSE CODE: SBSCHE504

Learning Objectives:

- To introduce the importance of statistical analysis of data and learn about parameters affecting accuracy and precision of the data.
- To impart knowledge about different sampling techniques used for sampling of solids, liquids and gases and various sub sampling methods used in chemical analysis.
- To introduce various concentration units, their interconversion and importance of limiting reagent concepts. To apply the knowledge acquired to solve a hypothetical problem.
- To learn about solvent extraction and SPE as a tool of pre-concentration and separation.
- To introduce the learner to the various types of chromatographic separation methods used in the field of analytical chemistry.
- To learn principle,working and applications of atomic spectroscopy

Learning Outcomes:

The learner will be able to

- apply statistical tests to the given data or the data generated in the laboratory to comment on the accuracy and precision of a given method and to correlate between two different methods used for the same sample.
- understand and select appropriate tools to be used for different samples and the importance of sub-sampling.

- work comfortably with different concentration units, inter-convert them as per requirement and understand controlling of reactant concentration to increase yield in the lab and also at industrial level.
- compare different spectroscopic methods with regards to working ,limitations and advantages
- to calculate concentrations of unknown compounds from given data
- learn the uniqueness of each separation method, understand and apply the methods for separation of mixtures and to compare with other instrumental methods of separation.

PRACTICALS P-IV

Learning Objectives:

- To train learners to prepare standard solutions of known concentration.
- To train learners to handle and standardize analytical instruments for its optimum use.
- To introduce the learner to various classical and instrumental methods of analysis to real life and commercial samples.

Learning Outcomes:

he learner will be able to

- decide suitability of an instrument for its use in analysis.
- learn to prepare and standardise solutions with the highest degree of accuracy.
- analyse different samples using various methods of chemical analysis

Sophia College (Autonomous)

SEMESTER VI

COURSE CODE: SBSCHE604

Learning objectives:

- To study various types of classical methods of titration and to determine their end point graphically and by calculation.
- To learn about complexometric titrations with regards to theory, suitability and applications.
- To understand the theory behind precipitation titration and its importance in the determination of halides.
- To learn classical methods of chromatography as a tool for separation and identification.
- To learn gas chromatography as a technique for separation and identification of volatile compounds.
- To understand the principle, instrumentation and application of polarography and amperometry
- To know about different thermal methods and to study thermogravimetric analysis of various compounds as a tool for identification and quantification.
- To get basic knowledge of NAA as a radio analytical method.

Learning outcomes :

Learner will be able to

- calculate the theoretical end point of titrations graphically and by calculations.
- comprehend theory, working and applications of TLC, PC and GC.
- decide a suitable method for a given halide depending on the conditions.
- explain principle and working of polarography and amperometry
- calculate polarographic parameters using Ilkovic equation for given data
- plot and interpret the thermogram for a given compound.
- understand and write applications of TGA and NAA.

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PRACTICALS

Learning Objectives:

- To train learners to prepare standard solutions of known concentration.
- To train learners to handle and standardize analytical instruments for its optimum use.
- To introduce the learner to various classical and instrumental methods of analysis to real life and commercial samples.

Learning Outcomes:

The learner will be able to

- decide suitability of an instrument for its use in analysis.
- learn to prepare and standardise solutions with the highest degree of accuracy.
- analyse different samples using various methods of chemical analysis.

Sophia College (Autonomous)

TYBSC CHEMISTRY APPLIED COMPONENT

SEMESTER V

PHARMACEUTICAL AND COLOUR

CHEMISTRY SBSAPC501

Objectives

- Understand the classification of drugs, basic terms used in medicinal chemistry, and routes of drug administration.
- To understand the various pharmacodynamic agents with respect to chemical structure, therapeutic action and uses.
- Understand the synthesis of certain drugs that are available in the market
- To familiarise the learner with the terminology/nomenclature related to dyestuff and pharmaceutical industry
- To understand the origin, mode of application, classification of dyes, pigments and fluorescent brighteners.
- To understand the correlation between the colour of a compound and the structure
- To understand the science behind dye fibre attachment.
- To learn the processes involved in the synthesis of dyes/drugs and their intermediates.

Outcomes

Learners should be able to

- Define various terms used in medicinal chemistry
- Reproduce the synthesis of drugs
- Predict the use of the drug
- Define various terms related to pharmaceuticals and color chemistry
- To be able to identify, predict, classify commercially available dyes based on terminology/nomenclature.
- To predict the brightness of dyes based on the structure.
- To be able to predict the nature of dye-fibre attachment and the fastness of dyes

Sophia College (Autonomous)

PRACTICALS 24

Objectives

- To prepare dyes on a bench scale
- To estimate the drug samples quantitatively
- To learn the application of colorimeter/spectrophotometer in the assay of drugs.
- To develop the skill of dyeing of fabric Outcomes
- Enable the learner to analyse commercial samples of drugs using a suitable method.
- Learner will be equipped with the skills of synthesis of dyes on a bench scale and dyeing of fabric

SEMESTER VI

PHARMACEUTICAL AND COLOUR

CHEMISTRY SBSAPC601

Learning Objectives

Learner will understand
- the drug, discovery, design, development and metabolism of drugs
- the various chemotherapeutic agents with respect to chemical structure, therapeutic action and uses.
- the synthesis of commercial drugs
- the classification of dyes based on their structure.
- the synthesis of dyes/drugs and their intermediates.
- the use of the non-textile dyes, their properties and characteristics.
- the effect of the dyestuff industry on the environment and remediation processes

Learning Outcomes

Learner will be able
- Explain the process of drug discovery design and development
- write the synthesis of drugs
- Predict the use of a drug
- Identify and classify the dye based on their structure.
- To explain the effect of the dyestuff industry on the environment and apply the appropriate remediation process

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PRACTICALS 24

Learning Objectives

- To prepare drug and drug intermediates on a bench scale
- To learn the application of colorimeter/spectrophotometer in estimation of dyes.
- To acquaint learners with chromatographic techniques as a method of separation
- To learn quantitative analysis of dyes.
- To understand the importance of a monograph
- To give the learner an exposure of the workings of an industry

Learning Outcomes- The learner will be able to

- Perform a synthesis of drug or drug intermediate
- Analyse commercial samples of dyes using a given method.
- Perform quality control of a commercial sample of drug as per Indian Pharmacopoeia

Sophia College (Autonomous)

MSc Chemistry

Part - I

PHYSICAL CHEMISTRY

SEMESTER-I

COURSE CODE: SMSCHE101

Learning Objectives:

- To understand and elucidate the third law of thermodynamics and properties like absolute entropies, heat capacity, entropies of vaporization of liquids etc.
- To understand and elucidate the properties of wave function, quantum operators and application of quantum mechanics to different systems
- To understand the mechanism of some composite reactions, kinetics of polymerization reactions and theories for reaction in gas phase
- To study Debye Huckel Onsager equation, deviations from it and to understand different types of fuel cells
- To introduce terms, concepts and derivations involved in bio-electrochemistry

Learning Outcome : The learner will be able to

- discuss and elucidate the Third law of thermodynamics, Trouton's rule
- solve problems using the properties and relationships of thermodynamic fluids
- explain and use Quantum operators in solving numericals
- understand and explain Semenov – Hinshelwood and Thompson mechanism, RRK & RRKM theories
- elucidate Debye Huckel Onsager equation, Debye Falkenhagen effect, wein effect
- explain Bio electrochemistry concepts and derive Goldmann equation

Sophia College (Autonomous)

PRACTICALS

Course Code: SMSCHEP101

Learning Objectives:

- To train the students in handling various instruments, glassware, chemicals etc. used in various analyses
- To instruct the learner in practical knowledge on planning and performing experiments.
- To elucidate knowledge about the non-instrumental techniques

Learning Outcomes:

The learner will be able to

- carefully handle and use various instruments used in the lab for performing experiments
- follow instructions thoroughly
- perform experiments with accuracy and perfection

INORGANIC CHEMISTRY

SEMESTER-I

COURSE CODE: SMSCHE102

Learning objective

- To understand wave functions for different hybridizations and bonding in diatomic and polyatomic species
- To understand construction of character tables for different point groups and applications of group theory
- To understand the methods of preparation and properties of co-ordination compounds and nano particles

Learning outcomes

The learner will be able to

- derive wave functions for different hybridization and plot MOT diagrams for diatomic and polyatomic species
- construct character tables for different point groups and apply of group theory to inorganic molecules
- write the methods of preparation and explain the properties of co-ordination compounds and nano particles

Sophia College (Autonomous)

PRACTICALS

Course Code: SMSCHEP102

Learning objectives

- To train students to prepare simple nano particle
- To use classical methods to estimate percentage of metal in alloys/ores
- To use instrumental methods of analysis for estimation of metal ions and inorganic compounds

Learning outcomes

The learner will be able to

- Prepare simple nanoparticles and characterize them using absorption methods
- Identify and use simple classical methods and calculate percentage composition of metals in alloys/ores
- Estimate metal ions and inorganic compounds using instrumental methods

ORGANIC CHEMISTRY

SEMESTER-I

COURSE CODE: SMSCHE103

Learning Objectives

- Understand the mechanisms of reactions and the effect of various parameters on the rate of the reaction, stereochemistry and selectivity of the product.
- Understand the criteria of aromaticity, thermochemical and magnetic criteria for aromatic compounds of benzenoid and non-benzenoid structures.
- Learn to draw the Frost Musulin Diagrams for various compounds.
- Understand the stereochemical concepts in molecules with constitutionally symmetric and asymmetric stereoisomers.
- Understand the principles of axial and planar chirality.
- Understand the configurational descriptors to allenes, alkylidene cycloalkanes, spirans, biaryls (including BINOLs and BINAPs), ansa compounds, cyclophanes,

- Understand the concepts of topicity, criteria for enantiotopic and disastereotopic ligands and faces and identify them in a stereoisomer.
- Understand how to assign configurational descriptors for enantiotopic and diastereotopic faces
- Understand the concept of prochirality and predicting them in a molecule

Learning Outcomes

- Students are expected to predict a mechanism, rate of the reaction, stereochemical outcome of reactions.
- Knowledge of the parameters and evidence used to predict the mechanism of the reaction.
- Understanding the factors affecting acidity and basicity and involvement of acids and bases in determining the mechanism.
- Classify the compounds based on criteria of aromaticity, analyse the thermochemical and magnetic data for aromatic compounds of benzenoid and non-benzenoid structures
- Predicting the aromaticity in cyclic compounds based on Frost Musulin diagram
- Predicting the stereochemical concepts in molecules with constitutionally symmetric and asymmetric stereoisomers.
- Applying the principles of axial and planar chirality.
- Assigning configurational descriptors to allenes, alkylidene cycloalkanes, spirans, biaryls (including BINOLs and BINAPs), ansa compounds, cyclophanes,
- Predicting topicity, evaluating the criteria for enantiotopic and disastereotopic ligands and faces and identifying them in a stereoisomer and assigning configurational descriptors
- Identifying a prochiral center in a given molecule and assign the configurational descriptors
- Predicting Selectivity and specificity of the various oxidizing and reducing reagents and the mechanisms
- Identifying suitable reagents required for designing synthesis via functional group interconversion.

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PRACTICALS

Course Code: SMSCHEP103

Learning Objectives:

Learner will learn

- To synthesize organic compounds.
- To purify the given compound by suitable method
- Techniques of TLC to study the progress of a reaction

Learning Outcomes:

Learner will be able to

- Prepare organic compounds at micro scale
- To assess the purity of the prepared compound
- Monitor the progress of the reaction using TLC

ANALYTICAL CHEMISTRY

SEMESTER-I

COURSE CODE: SMSCHE104

Learning Objectives:

- To introduce important terms involved in analytical chemistry
- To create awareness about quality, accreditation and GLP
- To learn and use appropriate concentration units and predict yield of a reaction.
- To learn about FTIR and UV-Vis spectroscopy as an analytical tool.
- To learn about DSC, DTA and thermometric titration methods as a method for the characterisation of various substances.

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Learning Outcome:

The learner will be able to

- understand the use and importance of various terms used in analytical chemistry.
- be able to comprehend various quality standards and safety rules followed in the laboratories.
- interconvert various concentration units and assess conditions to improve reaction yield.
- explain the working and applications of IR, FTIR and UV-Vis spectroscopy in various fields
- able to solve numerical problems on simultaneous spectroscopy.
- interpret thermograms of various compounds for identification and quantification

PRACTICALS

Course Code: SMSCHEP104

Learning Objectives:

- To learn analysis of individual and mixture of components by classical and instrumental methods learnt in theory.
- To learn the role of different solvents in sample pre-treatment to enhance accuracy of the result..
- To get highly reproducible and accurate results irrespective of the origin of the sample.

Learning Outcome:

The learner will be able to

- use concepts learnt in theory for solving practical problems.
- understand and apply the knowledge acquired in theory to different types of samples for its characterisation and estimation.
- be able to work comfortably at different concentrations with the highest degree of accuracy and reproducibility

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PHYSICAL CHEMISTRY

SEMESTER-II

COURSE CODE: SMSCHE201

Learning Objectives:

- To understand the concept of fugacity, Gibbs energy of mixing, relation of partial molal quantity with thermodynamic properties
- To understand thermodynamics of surfaces and free energy changes of biochemical reactions
- To emanate schrodinger equation in spherical coordinates, quantization of rotational energy and spherical harmonics, total wave functions, probability density functions and interdependence of quantum numbers
- To learn kinetics of enzyme catalyzed reactions, different types of inhibitions of enzymes and kinetics of reactions in solid state.
- To understand different types and thermodynamics of formation of defects
- To summarize phase equilibria for two component and three component systems

Learning Outcomes:

Learner will be able to

- deduce fugacity of real gases using graphical methods.
- elucidate Laplace, Kelvin equation and derive Gibbs adsorption isotherm and BET isotherm
- understand and explain two particle problems and separation of variables, expressions for the total wave function for 1s, 2s, 2p and 3d orbitals of hydrogen.
- elaborate the general mechanisms of acid-base catalysis, enzyme catalysis and effect of pH & temperature on them.
- extrapolate mathematical equation to find concentration of defects and solve numerical problems based on it.
- understand and explain two component systems and three component systems.

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PRACTICALS

Course Code: SMSCHEP201

Learning Objectives:

- To train the students in handling various instruments.
- To get practical knowledge on planning and performing experiments.
- To gain knowledge about the non-instrumental techniques
- To solve equations mathematically to plot graphs and interpret them.

Learning Outcomes:
Learner will be able to

- be equipped with technical skills to work with various instruments.
- correlate the theoretical knowledge with the practical experiments.
- Mathematically solve equations and Interpret graphical plots.

INORGANIC CHEMISTRY

SEMESTER-II

COURSE CODE: SMSCHE202

Learning objectives

- To understand different types of reactions and their mechanisms for inorganic complexes of varying geometry
- To impart knowledge of sources, effects, control measures of radioactive pollutants and heavy metals
- To understand the role of metals in biological systems

Learning outcomes

The learner will be able to

- identify different types of reactions and their mechanisms for inorganic complexes of varying geometry
- suggest methods for environmental protection and explain effects of radiation and heavy metal
- explain the role of metals in biological systems

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PRACTICALS

Course Code: SMSCHEP202

Learning objectives

- To train students to prepare and analyze inorganic complexes of various geometries
- To use various optical methods for analysis of inorganic compounds

Learning outcomes

The learner will be able to

- prepare and analyze inorganic complexes
- perform analysis of various compounds using suitable optical method

ORGANIC CHEMISTRY

SEMESTER-II

COURSE CODE: SMSCHE203

Learning Objective

- Understanding the formation of enolate.
- Understanding the regioselectivity of alkylation of enolates, Enamines, imines and their nitrogen analogs.
- Understand the mechanisms of reactions and the effect of various parameters on the rate of the reaction, stereochemistry and selectivity of the product.
- Understanding chemical reactions with the help of FMO.
- Understanding HUMO - LUMO gap in UV absorption spectra and interpreting the reactivity of the given compounds.
- Understand the basic concepts of Molecular spectroscopy.

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Learning Outcome:

- Predict the formation of enolates.
- Predict the mechanism, rate of the reaction, stereochemical outcome of reactions.
- Write the Industrial application of reactions
- Able to draw the FMO's of alkenes, Formaldehyde, allyl anion and cation.
- Apply the concept of FMO's to substitution and addition reactions.
- Able to predict whether the reaction is chemically/ photochemically feasible
- Analyse the effect certain factors on spectrum of the compound
- Interpretation of spectral data and elucidation of structure

PRACTICALS

Course Code: SMSCHEP203

Learning objective: Learner will

- Understand the method and concept of separation and learn to separate a binary mixture quantitatively by chemical method.
- Learn to perform qualitative analysis, prepare a derivative and identify one of the components
- Learn the method of purification of the components.
- Learn to interpret the spectrum.

Learning outcomes:

Learner will be able

- To identify the nature of a binary mixture and separate the mixture quantitatively.
- To perform organic qualitative analysis
- To purify compounds by distilling/recrystallization techniques.
- To elucidate the structure of a compound based on spectra

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ANALYTICAL CHEMISTRY

SEMESTER-II

COURSE CODE: SMSCHE204

Learning Objectives:

- To learn the principle and working of various chromatographic methods for separation and identification of mixture of unknown compounds by using suitable detectors.
- To understand application of different X-ray spectroscopic methods as a tool for surface studies.
- To learn the principle and working of MSwith different analysers as a tool for structural elucidation of organic compounds.
- To learn about advanced electroanalytical methods to analyse mixtures.

Learning Outcomes: The learner will be able to

- explain various chromatographic, ICP-AES and X-ray spectroscopic methods with emphasis on principle and working of the instrument.
- draw a simple block/schematic diagram of the instruments learnt and explain the importance of each component.
- carry out structural elucidation of simple organic compounds from the MS data.
- comprehend applications of isotope dilution method and solve numerical problems for a given data.
- explain various types of electroanalytical methods and compare advantages and limitations of one over the other.

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PRACTICALS

Course Code: SMSCHEP204

Learning Objectives:

- To learn analysis of the mixture of two or more species using a classical or instrumental method.
- To learn handling of different instruments.
- To use a given method to comment on the quality of the compound.

Learning Outcomes:

The learner will be able to

- analyse a given mixture with the highest degree of accuracy by using classical or instrumental method of analysis.
- check the quality of any given compound.
- handle various instruments confidently.
- perform analysis at various concentrations.

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MSc Chemistry

PART - II

SEMESTER III

SMSCHE301: QUALITY IN ANALYTICAL CHEMISTRY

Learning Objectives:

- To understand various methods of sampling and criteria for method validation.
- To understand the principle, instrumentation and applications of different chromatographic techniques.
- To understand the different methods used to reduce signal to noise ratio
- To introduce the concept of regulatory affairs in drug pharmaceuticals and laboratory maintenance.

Learning Outcome:

Learner will be able to-

- Explain dissolution technology and methods of sampling and storage.
- Interpret the results and improve the quality of results
- Describe methods used to reduce signal to noise ratio
- Explain supercritical fluid chromatography, affinity chromatography and ion-exchange in detail with applications.

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SMSCHE302: ADVANCED INSTRUMENTAL TECHNIQUES

Learning Objectives:

- To understand the principles and instrumentation of the spectral methods
- To understand the applications of the techniques discussed
- To understand the concepts of the different techniques i.e. spectroscopic/electroanalytical.

Learning outcomes:

Learner will be able to

- Differentiate and identify the technique of analysis for a sample.
- Interpret the esr/ mossbauer spectrum.
- Solve numericals based on the topics covered
- Compare the different techniques i.e. spectroscopic/electro-analytical.
- Describe the applications of the techniques discussed

SMSCHE303: BIOANALYTICAL CHEMISTRY AND FOOD ANALYSIS

Learning Objectives:

- To understand the analytical applications in the chemical and biological fields
- To understand immunological methods and food analysis using a variety of experimental techniques
- To understand the applications of the techniques discussed
- To introduce quality assessment of dairy products and species

Learning outcomes:

Learner will be able to

- Differentiate and identify the techniques of analysis
- Apply the knowledge for estimating dairy products
- Describe the applications of the techniques used

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SMSCHE304:

ENVIRONMENTAL & PHARMACEUTICAL CHEMISTRY AND INDUSTRIALLY IMPORTANT MATERIALS

Learning Objectives:

- To introduce learners to different types of pollution, analysis of pollutants and environmental laws and regulations.
- To provide them with a scientific background for understanding environmental problems, monitoring and controlling the pollution.
- To understand the application of analytical chemistry from the perspective of pharma and other industrially important materials.

Learning Outcomes:

After completion of the course, the student will be able to:

- Interpret quality parameters with reference to air, soil and water.
- Apply Sampling techniques and analyses of various environmental material
- Interpret Environmental regulations.
- Analyse various industrial and pharmaceutical materials.

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Semester III

Practical

Learning Objectives

- To learn and operate HPTLC and Fluorometry.
- To learn quantitative analysis of various food, cosmetic and drug samples
- To be acquainted with separation techniques
- To learn how to check the purity of various samples
- To acquaint learners with chromatographic techniques
- To familiarize students with the SOPs and train them in handling of various instruments

Learning Outcomes: -Learner will be able to

- Analyse commercial samples of food, cosmetic and drug.
- Apply the knowledge and choose an appropriate method for analysis based on requirements
- Use technical skills to work with various instruments.

SEMESTER IV

SMSCHE401: QUALITY IN ANALYTICAL CHEMISTRY

Learning Objectives:

- To understand various methods of separation used in pre-treatment of samples.
- To introduce analysis of herbal based products and their standardizations.
- To emphasize the importance of Green Chemistry.
- To understand the principle, instrumentation and applications of selective chromatographic techniques

Learning Outcome: Learner will be able to-

- Explain in detail the application of solvent extraction in analytical chemistry
- Describe qualitative and quantitative estimations of herbal based formulations and interpret the results.
- Identify and use green reactions/synthesis in future.
- Discuss analytical techniques in nanotechnology and selective chromatographic techniques

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SMSCHE402: ADVANCED INSTRUMENTAL TECHNIQUES

Learning Objectives:

Students will be able to

- Understand the principles and instrumentation of the spectral, radiochemical and thermal methods of analysis.
- Understand various hyphenated methods of analysis
- Understand the applications of the techniques discussed in the paper.

Learning outcomes: Students can

- Differentiate and identify the technique of analysis for a sample.
- Interpret the mass spectrum.
- Solve numericals based on the topics in the paper
- Justify the benefits of hyphenated techniques
- Compare the different techniques ie spectroscopic/radioanalytical/thermal.
- Describe the applications of the techniques discussed in the paper.

SMSCHE403: SELECTED TOPICS IN ANALYTICAL CHEMISTRY

Learning Objectives:

- To impart knowledge of effluent treatments and recovery of metals from effluents, recycling and reuse of effluent water.
- To impart knowledge of solid waste management, analysis of polymers, paints and pigments
- To understand the applications of analytical techniques in Forensic Chemistry and metallurgy

Learning Outcomes: Learner will be able to

- Apply the concepts of waste management in day to day life
- Analyse and Apply the appropriate methods of analysis of polymers, paints, ores and alloys
- Apply the knowledge in the field of forensic chemistry

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SMSCHE404

INTELLECTUAL PROPERTY RIGHTS AND CHEMINFORMATICS

Learning Objectives

- To achieve a common understanding of IPR laws in India and its economic value.
- To encourage innovation at the college level and encourage the filing of patents.
- To provide a basic introduction to fundamentals and applications of cheminformatics.
- Introduce students to python, RPi and IoT.
- The students will learn about the working of sensors and experiments controlled from the internet.

Learning outcomes:

- It will bridge the gap between industry and academia and facilitate technology transfer.
- Understanding IP issues around knowledge transfer can help get discoveries from the lab to the marketplace.
- Explain basic concepts of cheminformatics and will be able to implement computation of molecular descriptors and chemical similarity.
- Use Python for understanding cheminformatics software and IoT
- Design various application based experiments using sensors.
- Send and receive data from the server.
- Handle live data generated without human intervention.

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Semester IV- Practical

Objectives

- To learn analysis of various food, water and forensic samples qualitatively and quantitatively
- To learn treatment ore/alloy samples and determine its constituent metals quantitatively
- To acquaint learners with chromatographic techniques
- To familiarize students with the SOPs and train them in handling various instruments.
- To acquaint them with the recent advances in the field of computational chemistry
- To inculcate in students a research aptitude.

Outcomes

- To enable learners to analyse commercial samples .
- To enable to apply the knowledge and choose an appropriate method for analysis based on requirements
- Learners will be equipped with technical skills to work with various instruments.
- To enable learners to apply skills and knowledge in the field of research and industry