Department of Chemistry (B.sc)

B.Sc. Organic Chemistry

Program Outcomes (POs)	
PO1	Demonstrate a comprehensive understanding of basic concepts in chemistry across various branches.
PO2	Identify and categorize different types of chemical substances and their properties.
PO3	Conduct experiments safely and effectively using standard laboratory techniques.
PO4	Apply knowledge of chemistry to solve fundamental scientific problems.
PO5	Analyze and interpret data from chemical experiments.
PO6	Understand the principles underlying chemical reactions and processes.
PO7	Recognize the importance of chemistry in everyday life and its impact on the environment.
PO8	Utilize various analytical methods to study chemical substances and their interactions.
PO9	Demonstrate proficiency in basic laboratory skills and procedures.

Program Specific Objectives (PSOs)	
PSO-1	Understand key concepts in organic, inorganic, and physical chemistry.
PSO-2	Perform laboratory experiments related to different branches of chemistry.
PSO-3	Analyze chemical reactions and processes in practical scenarios.
PSO-4	Apply basic techniques of qualitative and quantitative analysis in chemistry.
PSO-5	Recognize the significance of chemistry in societal and environmental contexts.
PSO-6	Engage with contemporary issues in chemistry and their relevance to modern science.
PSO-7	Develop an understanding of the applications of chemistry in various fields, including industry and research.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

F.Y. Semester I	
CH-101 : Physical Chemistry	
CO1	Define key terms related to chemical energetics, chemical equilibrium, and ionic equilibria, including standard enthalpy, Gibbs free energy, and ionization constants
CO2	Explain the fundamental principles of thermodynamics, including the laws of thermodynamics and the significance of the third law in calculating absolute entropies.
C03	Apply Kirchhoff's equation to calculate the variation of enthalpy with temperature for given chemical reactions and evaluate bond energies from thermochemical data.
C04	Analyze the factors affecting equilibrium constants, differentiating between exergonic and endergonic reactions and interpreting the molecular basis of equilibrium.
C05	Evaluate the impact of changes in temperature and pressure on chemical equilibria using Van't Hoff's equation and predict the response of equilibria under varying conditions.
C06	Design buffer solutions with specified pH values by selecting appropriate weak acids and their conjugate bases, and calculate the degree of hydrolysis for different salts to achieve desired pH conditions.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

F.Y. Semester I	
CH- 102: Organic Chemistry	
CO1	Define key concepts and terminology related to organic chemistry, including physical effects, electronic displacements, and reactive intermediates.
CO2	Explain the principles of stereochemistry, including the classification of isomers, chirality, and the significance of Hückel's rule in aromaticity.
C03	Apply knowledge of functional group reactions to predict and describe the preparations and reactions of alkanes, alkenes, and alkynes, using relevant mechanisms.
C04	Analyze the influence of structural factors on the acidity and basicity of organic compounds by comparing their pK values and understanding the effects of inductive and resonance stabilization
C05	Evaluate various reaction mechanisms (such as free radical substitution and electrophilic addition) in aliphatic hydrocarbons and assess their significance in organic synthesis.
C06	Design synthetic routes for the preparation of aliphatic hydrocarbons using selected reactions and evaluate the practicality and efficiency of these synthetic pathways.

F.Y. Semester I	
CH- 103: Chemistry Practical Course I	
CO1	Identify and explain the toxicity of common laboratory chemicals and the meaning of safety symbols found on chemical labels.
CO2	Describe the significance and content of Material Safety Data Sheets (MSDS) for hazardous chemicals, and summarize precautions necessary for handling these substances safely.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

C03	Apply thermochemical principles to experimentally determine heat capacity, enthalpy changes, and solubility parameters, demonstrating practical skills in calorimetry and calorimetric calculations.
C04	Analyze pH measurements of various solutions and evaluate the buffer capacity of prepared buffer solutions, comparing experimental results with theoretical values.
C05	Evaluate the presence of extra elements in organic compounds through qualitative analysis and critically assess the effectiveness of chromatographic techniques in separating constituents of mixtures.
C06	Design and execute experiments to prepare buffer solutions and analyze their buffer capacity, integrating knowledge of ionic equilibria and practical laboratory skills.

F.Y. Semester II	
CH-201: Inorganic Chemistry	
CO1	Define key concepts in atomic structure, including quantum numbers, types of chemical bonds, and SI units relevant to analytical chemistry.
CO2	Describe the significance and content of Material Safety Data Sheets (MSDS) for hazardous chemicals, and summarize precautions necessary for handling these substances safely.
C03	Apply thermochemical principles to experimentally determine heat capacity, enthalpy changes, and solubility parameters, demonstrating practical skills in calorimetry and calorimetric calculations.
C04	Analyze pH measurements of various solutions and evaluate the buffer capacity of prepared buffer solutions, comparing experimental results with theoretical values.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

C05	Evaluate the presence of extra elements in organic compounds through qualitative analysis and critically assess the effectiveness of chromatographic techniques in separating constituents of mixtures
C06	Design and execute experiments to prepare buffer solutions and analyze their buffer capacity, integrating knowledge of ionic equilibria and practical laboratory skills

F.Y. Semester II	
CH- 202: Organic Chemistry	
CO1	Identify and list the preparation methods and key reactions of aromatic hydrocarbons, alkyl and aryl halides, alcohols, phenols, ethers, and aldehydes and ketones.
CO2	Explain the origin and significance of quantum mechanics in describing atomic structure, including the Schrödinger equation and the wave-particle duality of matter
C03	Apply periodic trends and rules for electron configuration to predict the properties of elements, including effective nuclear charge, ionization energy, and electronegativity.
C04	Analyze various types of chemical bonds and their characteristics, including ionic and covalent bonds, using principles like lattice energy and hybridization to explain molecular geometry.
C05	Evaluate and compare anomalous electronic configurations and their stability, discussing the impact of exchange energy and half-filled or completely filled orbitals on chemical behavior.
C06	Design and conduct stoichiometric calculations to determine concentrations and prepare solutions, integrating knowledge of empirical and molecular formulas and various units of concentration

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

F.Y. Semester II	
CH- 203: Chemistry Practical –II	
CO1	Identify and list various techniques used in volumetric analysis and the specific reagents involved in the estimation of different compounds.
CO2	Explain the principles and significance of volumetric analysis, including the concepts of titration, stoichiometry, and the role of indicators in chemical reactions.
C03	Apply knowledge of synthesis techniques to prepare commercially important inorganic compounds, demonstrating correct laboratory procedures and safety measures.
C04	Analyze the results of titrations and syntheses, interpreting data to assess the purity and concentration of substances in volumetric analysis and inorganic synthesis
C05	Evaluate the effectiveness of different purification methods for organic compounds, such as recrystallization and distillation, based on yield and purity results.
C06	Design and conduct a laboratory experiment to synthesize a target organic compound using green chemistry approaches, documenting the reaction mechanisms and yield calculations.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

S.Y. Semester III	
CH-301: Physical and Analytical Chemistry	
CO1	Define and explain key concepts related to chemical kinetics, including rate laws, molecularity, and reaction order.
CO2	Discuss the factors affecting reaction rates and differentiate between zeroth, first, and second-order reactions using integrated rate laws.
C03	Apply integrated rate equations and graphical methods to determine the order of a given chemical reaction and solve related problems.
C04	Analyze adsorption processes by comparing physical and chemical adsorption, and classify given processes into their respective categories.
C05	Evaluate the effects of temperature on reaction rates using the Arrhenius equation, including the interpretation of activation energy from energy diagrams.
C06	Design a volumetric analysis experiment to determine the concentration of a solution using appropriate titration methods and indicators, incorporating standardization techniques.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

S.Y. Semester III	
CH-302: Inorganic and Organic Chemistry	
CO1	Define and explain key concepts related to Molecular Orbital Theory, including terms such as atomic orbitals, molecular orbitals, bond order, and magnetic properties.
CO2	Describe the principles of ligand types, coordination numbers, and Werner's theory of coordination compounds, including the differentiation between primary and secondary valencies.
C03	Apply IUPAC nomenclature rules to name coordination compounds and predict the structure of complexes based on coordination numbers.
C04	Analyze the mechanisms of electrophilic and nucleophilic substitution reactions in aromatic compounds and differentiate between the mechanisms of SN1, SN2, and SNi reactions.
C05	Evaluate the synthesis pathways for alcohols, phenols, and ethers, and assess the effectiveness of different reagents and conditions used in their preparation.
C06	Design a synthetic route for a target aromatic compound, incorporating knowledge of reaction mechanisms and expected yields, while justifying the choice of reagents and methods.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

S.Y. Semester III	
CH-303: Practical Chemistry-III	
CO1	Identify and describe the fundamental principles of chemical kinetics, including reaction orders and rate constants, through practical experiments involving the hydrolysis of esters.
CO2	Explain the mechanisms and significance of acid-catalyzed reactions and saponification processes, demonstrating comprehension through qualitative and quantitative analysis of reaction outcomes.
C03	Perform quantitative analyses to estimate the concentration of specific ions, such as Fe(III) and $BaCO_3$, using appropriate titration techniques and methodologies.
C04	Distinguish between various organic compounds through systematic qualitative analysis, utilizing techniques such as paper chromatography to separate and identify components in binary mixtures.
C05	Assess the effectiveness of different acid-base indicators during pH-metric titrations and critically evaluate the results obtained from volumetric analyses, expressing findings with appropriate statistical measures.
C06	Design and conduct a mini-project that applies green chemistry principles to synthesize a consumer product, demonstrating the ability to integrate theoretical knowledge with practical applications in real-world contexts.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

S.Y. Semester IV	
CH-401: Physical and Analytical Chemistry	
CO1	Define key terms related to phase equilibria, such as phase, component, degree of freedom, and the Gibbs phase rule.
CO2	Explain the differences between ideal and real solutions, including the application of Raoult's and Henry's laws in the context of liquid mixtures and their phase diagrams.
C03	Demonstrate the use of conductometric techniques to analyze solutions, including the interpretation of conductometric titration curves for strong acid-strong base and weak acid-strong base systems.
C04	Interpret the principles of colorimetry, including the derivation of Beer's law and its application in determining unknown concentrations of solutions through calibration curves.
C05	Critically assess the effectiveness of different chromatographic techniques (ion exchange, adsorption) in separating and purifying compounds, discussing their applications in real-world scenarios.
C06	Design an experiment utilizing column chromatography to separate specific metal ions from a mixture, detailing the choice of stationary and mobile phases and the expected outcomes based on chromatographic principles.

S.Y. Semester IV	
CH-402: Inorganic and Organic Chemistry	
CO1	Identify and define the different types of isomerism in coordination complexes, including polymerization, ionization, and geometric isomerism.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

CO2	Explain the principles of Valence Bond Theory (VBT) and its application in determining the structure and bonding of various coordination compounds, such as $[Ag(NH_3)_2]^+$ and $[Ni(CN)_4]^{2-}$.
C03	Apply Crystal Field Theory (CFT) to analyze the geometries and magnetic properties of octahedral, tetrahedral, and square planar complexes, including calculating crystal field stabilization energy.
C04	Compare and contrast the synthesis and reactivity of aldehydes, ketones, and carboxylic acids, demonstrating an understanding of their mechanisms and key reactions.
C05	Assess the differences in reactivity and preparation methods of aliphatic and aromatic amines, including their reactions and the significance of diazonium salts in organic synthesis.
C06	Design a synthetic pathway for a target molecule involving carboxylic acids or their derivatives, detailing the reagents and reactions necessary for each step while considering interconversion of functional groups.

S.Y. Semester IV	
CH-403: Practical Chemistry-IV	
CO1	Identify and describe the key techniques used in conductometry, chromatography, and adsorption, including their underlying principles and applications.
CO2	Explain the process and significance of synthesizing coordination compounds, including the relationship between the properties of the compounds and their molecular structures.
C03	Conduct experiments to determine the dissociation constant of a monobasic weak acid and analyze the data to draw conclusions about the acid's behavior in solution.
C04	Evaluate the results from various qualitative tests to confirm the separation of cations in chromatography, and interpret the effectiveness of different methods used in the separation process.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

C05	Assess the relationship between absorbance and concentration in colorimetric investigations, verify Beer's Law through experimental data and discuss the implications of deviations from ideal behavior.
C06	Design and execute an experiment to determine the molecular weight of an organic compound through titration, including the preparation of solutions and the proper setup of apparatus, while also writing balanced chemical equations for the reactions involved.

T.Y. Semester V	
CH- 501, Physical Chemistry I	
CO1	Analyze the historical development and fundamental principles of quantum mechanics and its application in chemistry.
CO2	Explain relationships between molecular structure, properties, and spectroscopic phenomena, including electromagnetic spectra and molecular energy levels. Explain relationships between molecular structure, properties, and spectroscopic phenomena, including electromagnetic spectra and molecular energy levels. Explain relationships between molecular structure, properties, and spectroscopic phenomena, including electromagnetic spectra and molecular energy levels.
C03	Apply mathematical models (Schrödinger equation, rotational and vibrational spectroscopy) to interpret molecular behavior.
C04	Analyze photochemical processes, laws (Grothus-Draper, Stark-Einstein), and quantum yields, relating them to molecular structure.
C05	Evaluate spectroscopic data (IR, Raman, microwave) to determine molecular structure and properties.
C06	Design experiments integrating quantum mechanics, spectroscopy, and photochemistry to predict molecular behavior and properties.

T.Y. Semester V	
CH-502: Analytical Chemistry- I	
CO1	Remembering (R): Define key terms in gravimetry, spectrophotometry, qualitative analysis, and instrumental analysis
CO2	Understanding (U): Explain principles of gravimetry, spectrophotometry, qualitative analysis, thermogravimetry, and differential thermal analysis.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

C03	Applying (A): Perform quantitative calculations, solve problems, and select appropriate analytical methods for given samples.
C04	Analyzing (AN): Identify important parameters in analytical processes, differentiate between analytical terms and methods, and design analytical procedures.
C05	Evaluating (E): Compare and distinguish between different analytical methods and techniques.
C06	Creating (C): Demonstrate theoretical principles through practical applications and design analytical procedures for real-world samples.

T.Y. Semester V	
CH-503: Physical Chemistry Practical - I	
CO1	Applying (A): Conduct experiments using refractometry, spectrophotometry, conductometry, and viscometry to determine various physical and chemical properties
CO2	Analyzing (AN): Interpret data from experiments, such as refractive indices, absorption spectra, conductivity, and viscosity to draw meaningful conclusions.
C03	Evaluating (E): Compare and distinguish between different analytical methods and techniques.
C04	Creating (C): Design and execute experiments to solve problems in analytical chemistry
C05	Understanding (U): Explain principles of refractometry, spectrophotometry, conductometry, and viscometry.
C06	Remembering (R): Identify and define key terms and concepts in analytical chemistry.

T.Y. Semester V	
CH-504: Inorganic Chemistry - I	
CO1	Understanding (U): Explain concepts of Molecular Orbital Theory, electroneutrality principle, Nephelauxetic effect, and transition metal chemistry.
CO2	Applying (A): Apply principles of Inorganic Reaction Mechanism, stability constants, and ligand substitution reactions to predict reaction outcomes.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

C03	Analyzing (AN): Compare and contrast different approaches to bonding in coordination compounds (VBT, CFT, MOT).
C04	Evaluating (E): Assess the properties and trends of transition elements, lanthanides, and actinides.
C05	Remembering (R): Identify and define key terms and concepts in coordination chemistry, inorganic reaction mechanisms, and solid-state chemistry.
C06	Creating (C): Design and predict the structure and properties of metals, semiconductors, and superconductors

T.Y. Semester V	
CH-505: Industrial Chemistry - I	
CO1	Understanding (U): Explain principles and processes involved in various chemical industries, including manufacturing, quality control, and safety measures.
CO2	Applying (A): Apply knowledge of unit operations and processes to design and optimize chemical production.
C03	Analyzing (AN): Compare and contrast different manufacturing processes, such as batch and continuous processes.
C04	Evaluating (E): Assess the economic, environmental, and social implications of chemical industries.
C05	Creating (C): Design and propose innovative solutions for chemical industry challenges.
C06	Remembering (R): Identify and define key terms, concepts, and technologies in chemical industries, including soap, detergent, dye, pigment, sugar, fermentation, and basic chemical manufacturing.

T.Y. Semester V	
CH-506: Inorganic Chemistry Practical - I	
CO1	Understanding (U): Explain principles and mechanisms of organic reactions, including polynuclear and heteronuclear aromatic compounds, active methylene compounds, rearrangement reactions, and elimination reactions.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

CO2	Applying (A): Apply knowledge of organic synthesis to design and predict outcomes of reactions.
C03	Analyzing (AN): Compare and contrast different types of organic reactions, mechanisms, and reactive intermediates
C04	Evaluating (E): Assess the reactivity and stability of organic compounds.
C05	Creating (C): Design and propose innovative synthetic routes for complex organic molecules.
C06	Remembering (R): Identify and define key terms, concepts, and mechanisms in organic chemistry

T.Y. Semester V	
CH-509: Organic Chemistry Practical-I	
CO1	Applying (A): Apply laboratory techniques to separate, purify, and analyze binary mixtures and prepare organic compounds.
CO2	Understanding (U): Explain principles of qualitative analysis, green chemistry, and sustainable practices in laboratory settings.
C03	Analyzing (AN): Analyze data from laboratory experiments and identify functional groups in organic compounds.
C04	Evaluating (E): Assess the efficiency and safety of laboratory procedures and chemical reactions.
C05	Creating (C): Design and optimize laboratory procedures for chemical synthesis and analysis
C06	Remembering (R): Demonstrate familiarity with laboratory instrumentation, techniques, and safety protocols.

T.Y. Semester V

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

CH-510: Skills Enhancing Course-I **CH-510 (A) : Introduction to Medicinal Chemistry**	
CO1	Understanding (U): Explain fundamental concepts of medicinal chemistry, drug discovery, and design.
CO2	Applying (A): Apply knowledge of bio-physicochemical properties to predict drug action and design.
C03	Analyzing (AN): Compare and contrast different classes of drugs and their mechanisms of action.
C04	Evaluating (E): Assess the efficacy, safety, and therapeutic potential of various drugs.
C05	Creating (C): Design and propose novel drug candidates using structure-activity relationships
C06	Remembering (R): Identify and define key terms, concepts, and principles in medicinal chemistry.

T.Y. Semester V	
CH-510 (B) : Polymer Chemistry	
CO1	Understanding (U): Explain fundamental concepts of medicinal chemistry, drug discovery, and design.
CO2	Applying (A): Apply knowledge of bio-physicochemical properties to predict drug action and design.
C03	Analyzing (AN): Compare and contrast different classes of drugs and their mechanisms of action.
C04	Evaluating (E): Assess the efficacy, safety, and therapeutic potential of various drugs.
C05	Creating (C): Design and propose novel drug candidates using structure-activity relationships
C06	Remembering (R): Identify and define key terms, concepts, and principles in medicinal chemistry.

T.Y. Semester V

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

CH-511: Skills Enhancing Course-II **CH-511 (A) : Environmental Chemistry**	
CO1	Understanding (U): Explain fundamental concepts of environmental chemistry, including biogeochemical cycles, water pollution, and analytical techniques.
CO2	Applying (A): Apply knowledge of water quality parameters and monitoring techniques to assess and mitigate water pollution.
C03	Analyzing (AN): Compare and contrast different types of water pollutants, their sources, and effects on the environment
C04	Evaluating (E): Assess the effectiveness of various water treatment methods and technologies.
C05	Creating (C): Design and propose sustainable solutions for environmental pollution and water conservation.
C06	Remembering (R): Identify and define key terms, concepts, and principles in environmental chemistry

T.Y. Semester V	
CH-511 (B) : Cheminformatics	
CO1	Understanding (U): Explain fundamental concepts of cheminformatics, molecular representation, and chemical structure search methods.
CO2	Applying (A): Apply cheminformatics tools and software for predicting properties, simulating spectral data, and computer-aided drug design
C03	Analyzing (AN): Compare and contrast different molecular representation methods, search algorithms, and cheminformatics software
C04	Evaluating (E): Assess the significance of cheminformatics in chemical science, drug discovery, and molecular modeling
C05	Applying (A): Apply cheminformatics tools and software for predicting properties, simulating spectral data, and computer-aided drug design Creating (C): Design and propose cheminformatics workflows for specific applications,

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

	utilizing machine learning and artificial intelligence.
C06	Remembering (R): Identify and recall cheminformatics concepts, molecular descriptors, and software operational principles

T.Y. Semester VI	
CH-601 : Physical Chemistry-II	
CO1	Understanding (U): Explain fundamental concepts of electrochemistry, crystallography, and nuclear chemistry.
CO2	Applying (A): Apply electrochemical principles to calculate EMF, predict electrode potentials, and analyze crystal structures using X-ray diffraction
C03	Analyzing (AN): Compare and contrast different types of electrochemical cells, crystal systems, and radioactive decay processes.
C04	Evaluating (E): Assess the applications of electrochemistry, crystallography, and radioisotopes in various fields
C05	Creating (C): Design and propose electrochemical cells, crystal structures, and radioactive decay experiments
C06	Remembering (R): Identify and recall key concepts, laws, and equations in electrochemistry, crystallography, and nuclear chemistry

T.Y. Semester VI	
CH-602 : Physical Chemistry-III	
CO1	Understanding (U): Explain colligative properties, kinetics of solid-state reactions, electronic structure, and polymer chemistry principles.
CO2	Applying (A): Apply colligative properties to determine molecular weight, analyze solid-state reaction kinetics, and calculate cohesive energy in ionic crystals and metals.
C03	Analyzing (AN): Compare and contrast different rate laws for solid-state reactions, electronic structures of conductors and insulators, and polymer classification and molecular weights
C04	Evaluating (E): Assess the significance of colligative properties, solid-state reactions, and polymer chemistry in various applications

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

C05	Creating (C): Design experiments to determine colligative properties, solid-state reaction kinetics, and polymer molecular weights.
C06	Remembering (R): Identify and recall key concepts, laws, and equations related to colligative properties, solid-state reactions, electronic structure, and polymer chemistry.

T.Y. Semester VI	
Physical Chemistry Practical-II	
CO1	Performing (P): Conduct experiments in potentiometry, pHmetry, radioactivity, colligative properties and turbidometry.
CO2	Analyzing (AN): Interpret data from experiments, calculate chemical properties and evaluate results
C03	Applying (A): Apply theoretical concepts to experimental design, data analysis and result interpretation
C04	Evaluating (E): Assess the accuracy and reliability of experimental methods and results
C05	Creating (C): Design and propose experiments to investigate chemical phenomena
C06	Understanding (U): Explain fundamental principles of physical chemistry underlying experimental methods

T.Y. Semester VI	
CH-604 : Inorganic Chemistry -II	
CO1	Understanding (U): Explain fundamental concepts of organometallic chemistry, homogeneous and heterogeneous catalysis, bioinorganic chemistry, inorganic polymers, and inorganic solids/ionic liquids.
CO2	Analyzing (AN): Compare and contrast different types of organometallic compounds, catalytic reactions, metalloproteins, inorganic polymers, and ionic liquids
C03	Applying (A): Apply principles of catalysis, bioinorganic chemistry, and inorganic polymer chemistry to industrial applications.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

C04	Evaluating (E): Assess the significance of organometallic compounds, catalysis, bioinorganic chemistry, and inorganic materials in technological advancements
C05	Creating (C): Design and propose experiments for synthesizing organometallic compounds, catalytic reactions, and inorganic polymers.
C06	Remembering (R): Identify and recall key concepts, reactions, and applications related to organometallic chemistry, catalysis, bioinorganic chemistry, inorganic polymers, and inorganic solids/ionic liquids

T.Y. Semester VI	
CH-605: Inorganic Chemistry -III	
CO1	Understanding (U): Explain acid-base theories, ionic solid structures, zeolite framework types, nanochemistry principles, and chemical toxicology concepts.
CO2	Analyzing (AN): Compare and contrast different acid-base models, ionic solid defects, zeolite synthesis methods, nanoparticle properties, and toxic chemical effects.
C03	Applying (A): Apply principles of acid-base chemistry, ionic solid structures, zeolite catalysis, nanochemistry synthesis methods, and chemical toxicology concepts to real-world applications.
C04	Evaluating (E): Assess the significance of acid-base theories, ionic solid properties, zeolite applications, nanoparticle properties, and toxic chemical effects on the environment.
C05	Creating (C): Design and propose experiments for synthesizing zeolites, nanoparticles, and studying chemical toxicology effects.
C06	Remembering (R): Identify and recall key concepts, theories, and applications related to acid-base chemistry, ionic solids, zeolites, nanochemistry, and chemical toxicology.

T.Y. Semester VI	
CH-606: Inorganic Chemistry Practical-II	
CO1	Performing (P): Conduct experiments in volumetric estimations, flame photometry, column chromatography, nanomaterial synthesis and complex synthesis.
CO2	Analyzing (AN): Interpret data from experiments, calculate chemical properties and evaluate results.
C03	Applying (A): Apply theoretical concepts to experimental design, data analysis and result interpretation.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

C04	Evaluating (E): Assess the accuracy and reliability of experimental methods and results.
C05	Creating (C): Design and propose experiments to investigate chemical phenomena.
C06	Understanding (U): Explain fundamental principles of analytical chemistry underlying experimental methods.

T.Y. Semester VI	
CH-607: Organic Chemistry-II	
CO1	Understanding (U): Explain fundamental principles of spectroscopy, including UV, IR, NMR, and mass spectroscopy.
CO2	Analyzing (AN): Interpret spectral data to determine the structure of organic compounds
C03	Applying (A): Apply spectroscopic methods to identify functional groups, determine molecular structure, and analyze chemical reactions.
C04	Evaluating (E): Assess the limitations and advantages of various spectroscopic techniques
C05	Creating (C): Design and propose experiments using spectroscopic methods to investigate molecular structure
C06	Solving (S): Solve structural problems using combined spectral data from UV, IR, NMR, and mass spectroscopy

T.Y. Semester VI	
CH-608: Organic Chemistry-III	
CO1	Analyzing (AN): Break down complex organic molecules into simpler synthons using retrosynthetic analysis.
CO2	Understanding (U): Explain the chemistry of reactive intermediates, organic reaction mechanisms and reagents used in synthesis

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

C03	Applying (A): Apply knowledge of organic reactions and reagents to design and propose synthesis routes for target molecules.
C04	Evaluating (E): Assess the efficiency and feasibility of different synthetic routes and reagents.
C05	Creating (C): Design and propose experiments for synthesizing complex organic molecules using various reactions and reagents.
C06	Solving (S): Solve problems related to organic synthesis, including retrosynthetic analysis, reaction mechanisms and reagent selection

T.Y. Semester VI	
CH-609: Organic Chemistry Practical-II	
CO1	Analyzing (AN): Interpret IR and NMR spectra to identify functional groups and determine structures of organic compounds.
CO2	Applying (A): Apply principles of organic estimation, extraction, and chromatography to analyze and separate organic compounds.
C03	Practicing (P): Demonstrate practical skills in handling chemicals, laboratory techniques, and instrumentation.
C04	Evaluating (E): Assess the accuracy and reliability of analytical results from IR, NMR, estimation, extraction, and chromatography experiments.
C05	Creating (C): Design and propose experiments for separating and analyzing complex organic mixtures
C06	Understanding (U): Explain fundamental principles of spectroscopy, estimation, extraction, and chromatography in organic chemistry

T.Y. Semester VI	
CH-610: Skill Enhancing Course-III **CH-610 (A) : Chemistry of Soil and Agrochemicals**	
CO1	Students will be able to recall the different components of soil, including mineral content, organic matter, and microorganisms, and define the basic physical and chemical properties of soil.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

CO2	Students will understand the classification of soil types based on pH and will be able to describe the effects of soil reactions, ion exchange, and buffering capacity on agricultural practices
C03	Students will be able to apply techniques for soil analysis, including determining pH, electrical conductivity (EC), total dissolved solids (TDS), and soil organic matter, using laboratory methods to assess soil fertility and reclamation needs
C04	Students will analyze the characteristics and problems associated with acidic, alkali, and saline soils, and will be able to differentiate between various soil types and propose suitable reclamation methods
C05	Students will evaluate the effectiveness of different fertilizers (nitrogenous, phosphatic, potassic, and nano fertilizers) and manures in improving soil health, plant growth, and nutrient efficiency, and recommend appropriate applications based on soil conditions.
C06	Students will design projects involving hands-on training in soil analysis and develop strategies for nutrient management and soil fertility enhancement, incorporating the use of biofertilizers and organic manures to improve sustainable agricultural practices.

T.Y. Semester VI	
CH-610 (B) Introduction to Forensic Chemistry	
CO1	Define key terms related to forensic science, including its historical development, fundamental principles, and classifications of narcotics and psychotropic substances
CO2	Explain the functions and significance of forensic science in society, including the scope and need for forensic investigations
C03	Demonstrate the procedures for collecting and preserving evidence of narcotics and psychotropic substances at crime scenes, including methods for testing
C04	Analyze various analytical techniques (e.g., thin layer chromatography, gas-liquid chromatography) used in the identification and testing of narcotics and psychotropic substances.
C05	Assess the implications of the NDPS Act, 1985, on the regulation of narcotics and psychotropic substances and the consequences of violations.
C06	Develop a comprehensive awareness campaign that educates the public about the dangers of designer drugs, including addiction and withdrawal symptoms.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

T.Y. Semester VI	
CH-610: Skill Enhancing Course-IV **CH-611(A): Analytical Chemistry-II**	
CO1	Define key terms and concepts related to solvent extraction, chromatography (HPLC and GC), atomic absorption spectroscopy (AAS), and flame emission spectroscopy (FES).
CO2	Explain the principles and theories underlying solvent extraction, chromatography, and atomic spectroscopic techniques, including distribution coefficients and the Van Deemter equation.
C03	Perform quantitative calculations related to solvent extraction and chromatographic analyses, including calculations involving distribution ratios and retention times.
C04	Differentiate between various analytical techniques and methods, identifying their specific applications and the important parameters influencing their effectiveness.
C05	Assess the appropriateness of different analytical methods for specific analytes and conditions, justifying the choice of methods based on sample characteristics and required sensitivity.
C06	Design an analytical procedure for a given sample, selecting appropriate methods and techniques based on the principles learned in the course.

T.Y. Semester VI	
CH-611 (B): Chemistry of Cosmetics and Perfumes	
CO1	Define key terms and concepts related to cosmetic chemistry, including the chemical composition and preparation methods of various cosmetic products like shampoos, hair dyes, and fragrances

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON

CO2	Explain the role of natural products and essential oils in cosmetic formulations, detailing their sources and significance in the industry.
C03	Prepare selected cosmetic products (e.g., talcum powder, shampoo, face cream) using standard formulations and techniques as outlined in the references.
C04	Analyze the regulations governing the cosmetic industry in India, including the steps for cosmetic registration and the role of the Central Drugs Standard Control Organization.
C05	Assess the safety and efficacy of cosmetic products by reviewing their chemical compositions and the potential regulatory requirements for their use in the market.
C06	Design a project plan for the preparation of a specific cosmetic product, incorporating relevant formulation principles, safety guidelines, and quality control measures.

PRINCIPAL
Sanjivani Arts,Commerce &
Science College,Kopargaon

Sanjivani Arts, Commerce & Science College
S.R.E.S.
KOPARGAON