Savitribai Phule Pune University

(Formerly University of Pune)

Styaniketan's

Adv. M. N. Deshmukh Arts, Science and Commerce College Rajur

B.Sc. in Chemistry

(Faculty of Science & Technology)

Course Outcomes

S.Y. B. Sc. Chemistry

(As Per National Education Policy-2020)

Semester-III

CHE-201-MJ-T: Physical Chemistry-I

Course Type: Major (Theory) No. of Credits: 2

Course Outcomes

At the end of the course student will be able to

1. Remember definitions, laws, and formulas related to reaction kinetics, thermodynamics, electrolytic conductance, and phase equilibrium.
2. Understand the rate laws of third-order reactions, thermodynamic concepts like entropy and free energy, ionic conductance, and phase diagrams.
3. Solve numerical problems using the Arrhenius equation, entropy changes, conductance laws, phase rule etc .
4. Compare methods for determining reaction order, thermodynamic processes, and conductance and phase systems.
5. Assess reaction mechanisms, thermodynamic feasibility, and conductance behavior of electrolytes.
6. Summarize the effect of temperature on reaction rate, phase stability, or ion mobility in solution.

CHE-202-MJ-T: Inorganic Chemistry-I

Course Type: Major (Theory) No. of Credits: 2

Course Outcomes

The end of the course, student will be able to

1. Learn key terms and concepts such as types of ligands, isomerism, hybridization, d-orbital shapes, and theories like VBT and CFT.
2. Explain the principles of coordination bonding, types of isomerism, and the structural implications of VBT and CFT in coordination compounds
3. Apply VBT and CFT to predict geometry, magnetic properties, and hybridization of coordination complexes
4. Compare types of isomerism and interpret orbital splitting patterns in octahedral, tetrahedral, and square planar complexes.
5. Determine the magnetic moment, ligand field strength and geometry of complexes.
6. Summarize the coordination compounds according to their geometry, spin state, and ligand environment using CFT and VBT concepts.

CHE-203-MJP: Chemistry Practical- III

Course Type: Major (Practical) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to learn,

1. Know the experimental procedures, formulas, and theoretical principles related to kinetics, thermodynamics, conductance, and coordination chemistry.
2. Understand the principles behind rate laws, enthalpy changes, conductometric titrations, colorimetry, and coordination complex formation.
3. Perform laboratory experiments to determine reaction order, heat changes, cell constants, and synthesize coordination compounds.
4. Analyze the reaction rates, calculate thermodynamic parameters, determine ligand ratios, and analyze chromatographic separations.
5. Evaluate the accuracy of results by comparing with theoretical values, validate Beer's Law, and evaluate coordination complex properties like color and magnetism.
6. Design experiments for synthesis, analysis, and characterization of coordination compounds.

CHE-221-VSC-T: Industrial Chemistry-I

Course Type: VSC (Theory) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Remember the definitions, industrial processes, pollution norms, raw materials, and key chemical manufacturing techniques used in large- and small-scale industries.
2. Understand the principles behind unit operations, pollution control technologies, green chemistry approaches, and the roles of industrial and plant chemists.
3. Apply knowledge of industrial processes like distillation, crystallization, and polymerization to real-world chemical production systems
4. Compare unit operations and unit processes, renewable vs. non-renewable resources, and heavy vs. fine chemical manufacturing.
5. Assess the environmental impact of industrial processes by interpreting pollution control standards (CPCB, EPA) and recommending improvements through green chemistry.
6. Design sustainable chemical production workflows that incorporate energy-efficient unit operations and eco-friendly purification methods for fine chemicals.

CHE-241-MN-T: Physical and Inorganic Chemistry

Course Type: Minor (Theory) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Learn key concepts such as the laws of thermodynamics, electrolytic conductance, and definitions related to coordination chemistry.
2. Know thermodynamic processes, conductivity variations, and bonding theories in coordination compounds.
3. Use formulas and concepts to calculate entropy changes, conductance values, and oxidation states in complexes.
4. Differentiate between various chemical processes like isothermal vs. adiabatic expansion, strong vs. weak electrolytes, and inner vs. outer orbital complexes.
5. Examine the effectiveness of theoretical models such as VBT and determine the feasibility of chemical processes based on thermodynamic and conductivity data.
6. To investigate conductance behavior or predict geometry and magnetism in coordination complexes.

CHE-242-MNP: Physical and Inorganic Chemistry Practical

Course Type: Minor (Practical) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to learn,

1. Recall experimental procedures, formulas, and theoretical principles related to kinetics, thermodynamics, conductance, and coordination chemistry.
2. Explain the principles behind rate laws, enthalpy changes, conductometric titrations, colorimetry, and coordination complex formation.
3. Perform laboratory experiments to determine reaction order, heat changes, cell constants, and synthesize coordination compounds.
4. Interpret experimental data to evaluate reaction rates, calculate thermodynamic parameters, determine ligand ratios, and analyze chromatographic separations.
5. Assess accuracy of results by comparing with theoretical values, validate Beer’s Law, and evaluate coordination complex properties like color and magnetism.
6. Design and conduct experiments for synthesis, analysis, and characterization of coordination compounds.

OE-202-CHE-T: Dairy Chemistry

Course Type: Open Elective (Theory) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Remember the composition of milk from various animals and identify key components such as proteins, fats, lactose, vitamins, and minerals.
2. Explain the functional roles of milk constituents in nutrition and dairy product processing such as coagulation and fermentation.
3. Apply knowledge of milk composition to detect adulteration and interpret changes in physicochemical properties like pH, viscosity, and acidity.
4. Differentiate between the types and functions of milk proteins and fats in the preparation of dairy products like cheese, butter, and yogurt.
5. Assess the quality and nutritional value of various dairy products by analyzing their chemical composition and processing methods.
6. Formulate or improve a dairy product (e.g., flavored yogurt or low-fat cheese) based on understanding of milk chemistry and processing techniques.

CHE-201-IKS-T: Ancient Indian Chemistry

Course Type: IKS (Theory) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Know the Indian Knowledge System and its significance in the protection of traditional knowledge.
2. Understand the need of the Indian Knowledge System (IKS) and significance of the ancient Indian Chemistry.
3. Relate the various concepts of ancient chemistry with the concepts of modern Chemistry.
4. Organize the contributions made by the ancient Indians in the field of Science and related concepts.
5. Evaluate the contribution of Indians in the development of chemistry.
6. Outline the chemistry heritage of ancient India.

CHE-231-FP: Field Project

Course Type: Field Project (FP) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Learn the fundamental chemistry concepts to real-world environmental and community
2. Understand the appropriate methodologies for collecting chemical and environmental data through fieldwork.
3. Apply the chemistry concepts to real life problems or environments
4. Analyse the experimental or observational data to derive meaningful conclusions about local chemical or environmental conditions.
5. Evaluate local problems through a scientific lens and suggest chemistry-based solutions or awareness strategies.
6. Prepare a scientific report and presentations based on their findings.

Semester-IV

CHE-251-MJ-T: Organic Chemistry-I

Course Type: Major (Theory) No. of Credits: 2

Course Outcomes

1. Recall basic concepts of acidity, basicity, reaction mechanisms, oxidation, reduction, and stereochemistry.
2. Explain the mechanisms of organic reactions involving halides, oxidizing and reducing agents, and stereochemical outcomes in cyclic systems.
3. Apply knowledge of acidity, basicity, nucleophilic substitution, oxidation, reduction, and stereochemical principles to predict the behavior of organic compounds.
4. Analyze reaction mechanisms, reactivity trends of halogenated hydrocarbons, and stability of substituted cyclohexane conformations.
5. Evaluate the choice of reagents and reaction conditions for achieving specific transformations in organic synthesis.
6. Develop synthetic strategies using organic reactions and stereochemical concepts.

CHE-252-MJ-T: Analytical Chemistry-I

Course Type: Major (Theory) No. of Credits: 2

Course Outcomes

At the end of the course, students will be able to

1. Learn concepts, definitions, and reagents used in volumetric analysis, colorimetry, chromatography, and solvent extraction.
2. Explain the principles of titrations, Beer-Lambert law, chromatographic separation, and solvent extraction mechanisms.
3. Use standard analytical techniques to determine concentrations of substances through titration, colorimetry, chromatography, and extraction.
4. Interpret titration curves, calibration plots, chromatograms, and extraction efficiencies to assess analytical results.
5. Compare the accuracy, precision, and suitability of analytical techniques like redox titrations vs. complexometry or paper chromatography vs. TLC.
6. Perform an analytical procedure of titrimetric, colorimetric, or extraction methods to determine unknown concentrations in a sample.

CHE-253-MJP: Chemistry Practical – IV

Course Type: Major (Practical) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Remember the fundamental concepts, reagents, and functional group tests used in organic estimation, preparation, and volumetric analysis.
2. Explain the principles behind organic reactions, separation techniques, and titration methods used in qualitative and quantitative analysis.
3. Perform organic synthesis, separation of binary mixtures, and estimations using volumetric and chromatographic methods in laboratory settings.
4. Differentiate between organic functional groups in mixtures, interpret chromatograms, and analyze titration results to identify and quantify substances.
5. Assess the purity and identity of synthesized or separated compounds using melting point, TLC, and confirmatory tests; validate volumetric results through standardization.
6. Execute multi-step analytical procedures combining organic preparation, separation, and titration.

CHE-271-VSC-P: Industrial Chemistry Practical-I

Course Type: VSC (Practical) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Learn basic concepts of industrial preparations, qualitative estimations, and pollution control techniques used in chemical laboratories and industries
2. Explain the principles behind organic synthesis, water hardness estimation, and environmental sampling methods including their industrial significance.
3. Demonstrate the preparation of industrially important compounds like paracetamol and dyes, and perform titrimetric analysis for water and soil quality assessment.
4. Compare experimental results to evaluate chemical purity, water salinity, and environmental parameters using field and lab-based methods.
5. Evaluate the efficiency of pollution indicators, safety protocols, and synthetic routes based on lab outcomes and industrial practices.
6. Design and present a project/report synthesizing learnings from industrial visits and practical’s to propose improvements in industrial or environmental chemical practices.

CHE-291-MN-T: Organic and Analytical Chemistry

Course Type: Minor (Theory) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to learn,

1. Learn types of halogenated hydrocarbons, definitions, principles, and classification of titrations, chromatography techniques, acid-base theories, and .

2. Understand the theory behind the mechanisms of nucleophilic substitution and elimination, volumetric and chromatographic techniques.

3. Determine the acidity and basicity of organic compounds, prepare and standardize solutions of different concentration.

4. Differentiate between substitution mechanisms (SN1 vs. SN2), including the influence of structural and electronic factors, and types of titrations (e.g., redox vs. complexometric), chromatographic techniques.

5. Investigate the reactivity of halogenated hydrocarbons and suitability of indicators, titration methods, and chromatographic techniques for given analytical tasks.

6. Categorize the organic compounds based on their structure and reactivity, titration or chromatography techniques.

CHE-292-MNP: Organic and Analytical Chemistry Practical

Course Type: Minor (Practical) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Remember the fundamental concepts, reagents, and functional group tests used in organic estimation, preparation, and volumetric analysis.
2. Explain the principles behind organic reactions, separation techniques, and titration methods used in qualitative and quantitative analysis.
3. Perform organic synthesis, separation of binary mixtures, and estimations using volumetric and chromatographic methods in laboratory settings.
4. Differentiate between organic functional groups in mixtures, interpret chromatograms, and analyze titration results to identify and quantify substances.
5. Assess the purity and identity of synthesized or separated compounds using melting point, TLC, and confirmatory tests; validate volumetric results through standardization.
6. Execute multi-step analytical procedures combining organic preparation, separation, and titration to solve real-world chemistry problems.

OE-252-CHE-T: Agricultural Chemistry

Course Type: Open Elective (Theory) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Recall the types, composition, and properties of soil, fertilizers, pesticides, and key terms related to agricultural chemistry.
2. Understand the role of agricultural chemistry in crop nutrition, soil fertility, and pest control.
3. Demonstrate the ability to carry out basic soil tests, fertilizer selection, and pest control techniques in an agricultural setting.
4. Compare the types of fertilizers and pesticides based on composition, use, and environmental impact.
5. Examine the impact of various agricultural inputs like fertilizers and pesticides on crop productivity and environmental safety.
6. Design a sustainable farming plan integrating organic practices, appropriate fertilizers, and pest control strategies.

SEC-251-CHE-P: Basic Software in Chemistry

Course Type: SEC (Practical) No. of Credits: 2

Course Outcomes

At the end of the course, student will be able to

1. Name and draw structures of diverse organic compounds and determine their basic properties.
2. Illustrate key organic reactions (2,4-DNP, aldol, phthalimide) and their mechanisms.
3. Understand the fundamentals of computational chemistry (modeling, optimization, structure-property).
4. Build, analyze, and compare 3D molecular structures using visualization software.
5. Interpret periodic trends and predict chemical behavior using online resources.
6. Perform virtual titrations, solubility and basic thermodynamic calculations using online tools.

CHE-281-CEP: Community Engagement Project (CEP)

Course Type: Community Engagement Project (CEP) No. of Credits: 2

Course Outcomes

At the end of the course, Student will be able to

1. Identify the chemical aspects of local community issues such as water quality, waste management, or household chemical safety.
2. Understand the societal issues and can provide a scientific solution
3. Apply chemistry knowledge to promote awareness about safe chemical practices, sustainability, and green alternatives in daily life.
4. Analyse the effectiveness of community engagement activities based on feedback and participation data.
5. Assess the societal issues through the group-based outreach and community interactions.
6. Plan chemistry-related awareness activities such as demonstrations, campaigns, or surveys in schools or local communities.