Abeda Inamdar Senior College of Arts, Science and Commerce, Pune 411 001
(Autonomous)

Choice Based Credit System [CBCS]
Under NEP Guidelines
To be Implemented from
Academic Year 2023-24

Board of Studies (Chemistry)
Post Graduate Department of Chemistry and Research Center
Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Preface:

As per National Credits Framework (NCrF), the required learner's engagement time (including direct contact hours) for 40 credits for 1200 hours.

i. **Theory Courses:** A minimum of 15 hours of teaching per credit is required in a semester.

ii. **Laboratory Courses:** A minimum of 30 hours in laboratory activities per credit is required in a semester.

iii. **Internship/on Job Training (OJT)/ Apprenticeship:** Credits for internship shall be one credit per one week of internship (or 30 hours of engagement), subject to a maximum of 4 credits per Semester. The internship shall be monitored jointly by the faculty and Industry/ Organization Mentor.

iv. **Field-based Learning/ Practices:** These are the courses requiring students to participate in field-based learning/projects generally under the supervision of faculty. A minimum of 30 hours of learning activities per credit in a semester is required.

v. **Community engagements and services:** These are the courses requiring students to participate in field-based learning/projects generally under the supervision of faculty. The curricular component of 'community engagement and service' will involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems. 30 hours of contact time per credit in a semester along with 15 hours of activities such as preparation for community engagement and service, preparation of reports, etc., and independent reading and study. Thus, the total learner engaged time would be 90 hours for a 2-credit course.

vi. **Eligibility**: Eligibility for admission to the fourth year of four-year Honours with Research Degree Programmes as per UGC guidelines: Minimum CGPA of 7.5 or minimum 75% at three-year degree.

First Year Bachelor of Science (F.Y. B. Sc.)
Chemistry

Syllabus of Autonomy [2023-24]
Structure of F. Y. B. Sc. Chemistry [CBCS]

Semester	Offered as	Course code	Title of course	No. of Credits
I	Major	23SBCH11MM	Physical and Analytical Chemistry I	2
I	Major	23SBCH12MM	Inorganic and Organic Chemistry I	2
I	Major	23SBCH13MM	Chemistry Practical-I	2
II	Major	23SBCH21MM	Physical and Analytical Chemistry II	2
II	Major	23SBCH22MM	Inorganic and Organic Chemistry II	2
II	Major	23SBCH23MM	Chemistry Practical-II	2
II	Minor	23SBCH21MN	Foundation Course in Chemistry I	2
II	Minor	23SBCH22MN	Chemistry Practical in Fundamental Techniques I	2
I-VI	OE	23SBCH1OE	Chemistry in Daily Life	2
I-VI	OE	23SBCH2OE	Fundamentals of Food Safety	2
I-VI	VSC	23SBCH1VS	Chemistry Laboratory Techniques	2
III-VI	VSC	23SBCH2VS	Computer-Aided Drug Design and Discovery	2
I-VI	SEC	23SBCHSE	Food Safety and Quality Management	2
V	Major IKS	23SBCH51IK	Phytochemistry of Indian Medicinal Plants (IKS)	2

OE: Open Elective Course

VSC: Vocational Skill Course

SEC: Skill Enhancement Course

***N.B.:**

1. Each lecture (L) will be of 1 Hr.
2. Each practical of 5 Hr. with 12 practical per semester
3. 12 weeks for teaching 03 weeks for continuous assessments
4. For details refer UGC rules and regulations (CBCS for Science Program under Science & Technology)

Preamble:

The syllabus of Chemistry for First year has been redesigned for Choice Based Credit System (CBCS) under the guidelines of NEP, to be implemented form 2023-24. As per NEP, Chemistry department has adopted Major Discipline Specific Course (DSC) pattern and hence offering Chemistry as Major and Minor Subject at the UG Level. In addition, Chemistry department has offered OE, SEC, and VSC courses for the undergraduate students from the basket of six verticals as per NEP.

The fundamental structure of the B.Sc. Program will follow the CBCS pattern. For all the courses examination pattern will follow Continuous Internal Evaluation (CIE) constituting to 40% of the total marks in each theory and practical course and End Semester Examination (ESE) amounting to 60% of the total marks in each theory and practical course.

Syllabus for Chemistry Major (4 Theory and 2 Practical) and Chemistry Minor (2 Theory) subject for F.Y.B.Sc. is to be implemented from the year 2023-24. Syllabus for S.Y.B.Sc., T.Y.B.Sc. and Fourth year B.Sc. Honours and/or Fourth Year B.Sc. Honours with Research will be implemented from the year 2024-25, 2025-26 and 2026-27 respectively as per approved structure.

B. Sc. Programme Objectives and Outcomes

Programme Objectives:

1. To develop conscience towards social responsibility, human values and sustainable development through curriculum delivery and extra-curricular activities.
2. To develop scientific temperament with strong fundamental knowledge of the subject
3. To develop Outcome Base Evaluation System (OBES) for quality improvement.
4. analytical thinking and problem-solving skills needed for various entrance and competitive examinations and Post Graduate Studies
5. To establish Industry-Academia Linkage for skill development through on job training

Programme Outcomes:

1) The students will graduate with holistic development.
2) The students will be qualified to continue higher studies in their subject.
3) The students will be eligible to appear for various competitive examinations and pursue higher education.
4) The students will be able to apply for the jobs with necessary skill sets after B. Sc. Programme**.**

Programme Specific Objectives and Outcomes

Programme Specific Objectives:

The B.Sc. Chemistry Programme will enable the students

PSOB-1. To develop fundamental understanding of Principles of Chemistry as a discipline.
PSOB-2 To provide multidimensional prospects of personality development through offering various courses under Value Education, Skill Enhancement, Vocational Skill Enhancement and Multidisciplinary Open Electives.

PSOB-3. To understand various laws, concepts, formulae and develop problem solving skills in Chemistry.
PSOB-4. To familiarize with advance level Chemistry and applications required for higher studies.
PSOB-5. To get hands on training on various instruments and develop skills needed in Chemistry lab.

Programme Specific Outcomes:
After successful completion of B.Sc. Chemistry Course student will have:

PSOC-1. Fundamental knowledge of theory and practical courses in Chemistry.
PSOC-2. Understanding of structures, reactivity and mechanism and problem-solving skills.
PSOC-3. Skills in laboratory techniques and experience in instrument handling.
PSOC-4. Knowledge and confidence to pursue higher studies in Chemistry.
PSOC-5. Motivation, Knowledge and Skills to pursue research career.

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Syllabus for F.Y.B.Sc. Chemistry

2023-24 (CBCS-Autonomy 23 Pattern)

Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Major**
Course/ Paper Title	**Physical and Analytical Chemistry I**
Course Code	**23SBCH11MM**
Semester	**I**
No. of Credits	**2**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	Fundamental principles of mathematics used in Chemistry for problem solving and calculations.
2.	Laws and Concepts of Chemical Energetics and Thermodynamics.
3.	Primary Introduction of Analytical Chemistry as a branch of Chemistry
4.	Principles of Stoichiometry and Problem Solving

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	**Unit I: Chemical Mathematics** 1. The student understands the graphical representation and processing. 2. Students understands and uses the rules and differentiation and integration in chemical derivations
2.	**Unit II: Chemical Energetics** 1. Students will be able to apply thermodynamic principles to physical and chemical process

	2. Calculations of enthalpy, Bond energy, Bond dissociation energy, resonance energy 3. Variation of enthalpy with temperature–Kirchoff's equation
3.	**Unit III: Introduction to Analytical Chemistry** Introduction to Analytical Chemistry, Applications and Fundamental Concepts and Analytical Problems
4.	**Unit IV: Stoichiometry** Calculations of mole, molar concentrations and various units of concentrations which will be helpful for preparation of solution, calculations, expression and calculation of different concentration terms such as Normality, Molarity, Percent Concentration, Molality, parts per million, parts per billion, parts per thousand

Syllabus

Unit No.	Title with Contents	No. of Hours
I	**Chemical Mathematics:** Graph: Cartesian co-ordinates, plotting of graph from experimental data, equation of straight line, slope, Intercept & its characteristics. Derivative: Definition, Simple rules of differentiation partial differentiation, examples related to chemistry. Integration: Definition, Simple rules of Integration, Integration between limits, examples related to chemistry. **Ref. No. 1 Pg. No. 1-10** **Ref. No. 2 Pg. No. 3-27**	**8**
II	**Chemical Energetics** Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Problems **Ref. No. 1 Pg. No. 525-570** **Ref. No. 3 Pg. No. 1-50**	**7**

III	**Introduction to Analytical Chemistry** Meaning and analytical prospective, scope and function: Analytical problems and their solutions, trends in analytical methods and procedures **Ref. No. 5: Pg. No.7-9** **Ref. No. 6: Pg. No. 1-4**	**2**
IV	**Stoichiometry:** Units of measurements, SI units, distinction between mass and weight, mole, millimole and calculations, significant figures Solution and their concentrations: Molar concentrations, Molar analytical Concentrations, Molar equilibrium concentration, percent, concentration, part per million, part per billion, part per thousand, solution-dilatant volume ratio, functions, density and specific gravity of solutions, problem solving. Chemical Stoichiometry: Empirical and Molecular Formulas, Stoichiometric Calculations, Problem solving. **Ref. No. 4: Pg. No. 65-103** **Ref. No. 5: Pg. No. 259-260** **Ref. No. 6: Pg. No. 62-78**	**13**

References:

1. Puri, Sharma, Pathania, Principles of Physical Chemistry (47th Edition), Vishal Publishing Co.
2. R. L. Madan, Chemistry for Degree Students, as per UGC model Curriculum, S. Chand (2010)
3. N. B. Singh, S. S. Das, A.K. Singh, Physical Chemistry Volume-II, New Age International Publishers (2009)
4. G D Christian -Analytical Chemistry 5 th Edn.
5. Qualitative Organic Analysis, 4th Edn. by A. I. Vogel (ELBS)
6. Vogel's Quantitative Analysis, 5th Edn.

Additional Reading

1. J. N. Gurtu, A. Gurtu; Advanced Physical Chemistry, Pragati Edition
2. Samuel H. Maron and Carl F. Prutton, Principal of physical Chemistry, 4th Edition, Collier Macmillan Ltd.
3. Undergraduate Physical Chemistry, UGC curriculum Vol. I – Guria-Gurtu Pragati Prakashan
4. Textbook of Physical Chemistry – P. L. Soni, O. P. Dharmatma, U. N. Dash Sultan Chand and Sons

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2023-24 (CBCS-Autonomy 23 Pattern)

Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Major**
Course/ Paper Title	**Inorganic and Organic Chemistry I**
Course Code	**23SBCH12MM**
Semester	**I**
No. of Credits	**2 (30 Hrs)**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	Theories of Atomic Structure
2.	Periodic changes and relations in properties of elements
3.	Chemistry of Aliphatic and Aromatic Hydrocarbons

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	**Unit I: Atomic Structure** a) Various theories and principles explaining atomic structure. b) Origin of quantum mechanics and its need to understand structure of hydrogen atom. c) Significance of quantum numbers d) Shapes of orbitals
2.	**Unit II: Periodicity of Elements** Aufbau's principle, Pauli exclusion principle, Hund's rule of maximum multiplicity

	Design Skeleton of long form of periodic table Describe Block, group, modern periodic law and periodicity. Classification of elements as main group, transition and inner transition elements. Explain periodicity in properties of element Effective nuclear charge, shielding or screening effect; some numerical problems.
3.	**Unit III: Chemistry of Aliphatic and Aromatic Hydrocarbons** Aliphatic and Aromatic Hydrocarbons Mechanistic understanding of nature and reactivity of hydrocarbons. Application of various reactions to carry out interconversion between hydrocarbons.

Syllabus

Unit No.	Title with Contents	No. of Hours
I	**Atomic Structure:** Origin of Quantum Mechanics: Why study quantum mechanics? Quantum mechanics arose out of interplay of experiments and Theory Energy quantization- i) Black body radiation ii) The photoelectric effect iii) Wave particle duality a) The particle character of electromagnetic radiation b) the wave character of particle, iv) diffraction by double slit v) atomic spectra, Review of Bohr's theory and its limitations, Heisenberg Uncertainty principle. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). **Ref. No. 1: Pg. No. 1-38, 141-154**	**8**
II	**Periodic Table and Periodicity of Elements:** Periodic table: periodic table after 150 years, review on the eve of international year of periodic table [IYPT]. Periodicity of elements: Rules for filling electrons in various orbitals, electronic configurations of the atoms. Stability of half-filled and completely-filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations Long form of periodic table-s, p, d and f block elements, Detailed discussion of following properties of elements with reference to s and p block a) Effective nuclear charge, shielding or screening effect b) Atomic and ionic radii c) Crystal radii d) Covalent radii) Ionization	**7**

	energies e) Electronegativity, Pauling's / electronegativity scale f) Oxidation states of elements **Ref. No. 2: Pg. No. 8-33**	
III	**Chemistry of Aliphatic and Aromatic Hydrocarbons** Functional group approach for the following reactions (preparations & reactions with mechanism) to be studied in context to their structure. 1. Alkanes: Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation. 2. Alkenes: Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's Rule); cis alkenes (Partial Catalytic Hydrogenation) and trans alkenes (Birch reduction), Reactions: Cis-addition (alk. $KMnO_4$) and trans addition (bromine), Addition of HX (Markownikoff's and anti Markownikoff's addition), Hydration, Ozonolysis, 3. Alkynes: Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalide Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, Ozonolysis and oxidation with hot alk. $KMnO_4$. Problems based on interconversions of hydrocarbons (2 and more than 2 Step Reactions) 4. Benzene and Alkyl Benzenes: Introduction and IUPAC nomenclature, preparation (Case benzene): from phenol, by decarboxylation, from acetylene. Reactions (Case benzene and Alkyl Benzenes): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel Craft's alkylation and acylation (up to 4 carbons chain on benzene). Side chain oxidation of alkyl benzenes **Ref. No. 3: Pg. No. 73-114,143-176,177-221, 250-262, 310-328, 337-341 Ref. No. 4: Pg. No. 131-173** **Ref. No. 5: Pg. No. 201-297, 677-684**	**15**

References:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F. A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
3. Organic Chemistry by Morrison & Boyd, 6 th Edn.
4. A Guidebook to Mechanism in Organic Chemistry, by Peter Sykes, 6thEdn.
5. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

Additional Reading

1. Douglas, B. E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John

Wiley & Sons.

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Post Graduate Department of Chemistry and Research Center

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Offered as	**Major**
Course/ Paper Title	**Practical Course in Chemistry-I**
Course Code	**23SBCH13MM**
Semester	**I**
No. of Credits	**2 (60 Hrs)**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	Laboratory Safety and MSDS
2.	Practical application of Thermodynamic and Ionic Equilibrium
3.	Organic Purification and Organic Synthesis
4.	Tests for Food Adulteration

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	Understanding of importance of safety measures and precautions in laboratory
2.	Conceptual understanding of thermochemical parameters and related concepts.
3.	Preparation of buffer solutions and significance.
4.	Understanding of Purity of Chemicals and parameters to ascertain purity
5.	Elemental analysis of organic compounds (non-instrumental)

6.	Awareness of Food Adulteration and Methods of Detection

Syllabus

Sr. No.	Title with Contents	Practical Session
	Section A: Chemical and Lab Safety (Any Two)	
1.	Toxicity of the compounds used in chemistry laboratory.	**1**
2.	Safety symbol on labels of pack of chemicals and its meaning	**1**
3.	What are MSDS sheets? Find out MSDS sheets of at least 2 hazardous chemicals ($K_2Cr_2O_7$, Benzene, cadmium nitrate and sodium metal)	**1**
4.	Precautions in handling of hazardous substances like Conc. acids, ammonia and organic solvents.	**1**
	Section B: Thermochemistry (Any Four)	
5.	Determination of heat capacity of calorimeter for different volumes.	**1**
6.	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.	**1**
7.	Determination of enthalpy of ionization of acetic acid.	**1**
8.	Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl).	**1**
9.	Determination of enthalpy of hydration of copper sulphate.	**1**
10.	Study of the solubility of benzoic acid in water and determination of ΔH.	**1**
	Section C: Organic Chemistry	
11.	**Purification of Organic Compounds (Two Techniques)** Crystallization (From Water and Alcohol)	**1**
12.	Distillation (One Component Volatile)	**1**
13.	Sublimation (Microscale Technique)	**1**
14.	**Organic Qualitative Analysis (Two Compounds)** To determine type and detection of extra elements (N, S, Cl, Br, I) in Organic Compounds and Determine Functional Groups (containing up to two extra elements)	**1**
	Section D: Analytical Chemistry	
15.	**Tests for Food Adulteration (Any One) (As per DART defined by FSSAI)** Tests for Milk and Milk Products, Oils and Fats and Honey	**1**
16.	Tests for Salt, Spices & Condiments	**1**
17.	**Analysis of Commercial products containing inorganic substances (Any One)** Estimation of Ca from calcium supplementary tablet by complexometric titration.	**1**
18.	Estimation of acid neutralizing capacity of antacids like Gelusil tablet/ Gelusil syrup etc.	**1**
19.	Estimation of selectively Cu(II) from brass alloy by iodometrically (Use KIO_3 as primary standard for standardization of $Na_2S_2O_3$ and not $K_2Cr_2O_7$).	**1**

Reference Books:

1. Systematic Experimental Physical Chemistry, S.W. Rajbhoj and T.K. Chondekar, Anjali Publication (2013).
2. Advanced Experimental Chemistry volume - I, J.N. Gurtu R. Kapoor, S. Chand and Co. New Delhi.
3. Experimental Physical Chemistry, V. D. Athawale, P. Mathur, New Age International Publishers.
4. Experimental Physical Chemistry, R. C. Das, B. Behara, Tata McGraw Hill Publishing Co. Ltd.
5. A Senior Practical Physical Chemistry, Khosla, B. D.; Garg, V. C. & Gulati, R. Chand & Co.: New Delhi (2011).
6. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
7. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Text book of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
8. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
9. Prof. Robert H. Hill Jr., David C. Finster Laboratory Safety for Chemistry Students, 2nd Edition Wiley ISBN: 978-1-119-02766-9 May 2016
10. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version, ISBN 978-0-309-13864-2 | DOI 10.17226/12654, the National Academies Press Washington, D.C.

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Syllabus for F.Y.B.Sc. Chemistry

2023-24 (CBCS-Autonomy 23 Pattern)

Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Major**
Course/ Paper Title	**Physical and Analytical Chemistry II**
Course Code	**23SBCH21MM**
Semester	**II**
No. of Credits	**2 (30 Hrs)**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	Laws and Concepts of Chemical Equilibrium
2.	Laws and Concepts of Ionic Equilibria
3.	Principles of Organic Qualitative Analysis
4.	Principles of Chromatography (Paper Chromatography & TLC)

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	**Unit I Chemical Equilibrium** Knowledge of Chemical equilibrium will make students to understand 1. Relation between Free energy and equilibrium and factors affecting on equilibrium constant. 2. Exergonic and endergonic reaction 3. Gas equilibrium, equilibrium constant and molecular interpretation of equilibrium constant 4. Van't Haff equation and its application
2.	**Unit II Ionic Equilibria**

	Ionic equilibria chapter will lead students to understand 1. Concept to ionization process occurred in acids, bases and pH scale 2. Related concepts such as common ion effect, hydrolysis constant, ionic product, solubility product 3. Degree of hydrolysis and pH for different salts, buffer solutions.
3.	**Unit III Qualitative Analysis of Organic Compounds** i. Basics of type determination, characteristic tests and reactions of different functional groups. ii. Separation of binary mixtures and analysis iii. Elemental analysis -Detection of nitrogen, sulfur, halogen and phosphorous by Lassiagne test. iv. Purification techniques for organic compounds
4.	**Unit IV Chromatographic Techniques** Basics of chromatography and types of chromatographs. Theoretical background for Paper and Thin Layer Chromatography, Principle and Applications

Syllabus

Unit No.	Title with Contents	No. of Lectures
I	**Chemical Equilibrium:** Introduction: Free Energy and equilibrium - Concept, Definition and significance, the reaction Gibbs Energy, Exergonic and endergonic reaction. The perfect gas equilibrium, the general case of equilibrium, the relation between equilibrium constants, Molecular interpretation of equilibrium constant. The response of equilibria to conditionsresponse to pressure, response to temperature, Van't Hoff equation, Value of K at different temperature, Problems. **Ref. No. 1: Pg. No. 620-645** **Ref. No. 2: Pg. No. 236-261**	**6**
II	**Ionic Equilibria:** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts, Buffer solutions. Solubility and solubility product of sparingly soluble salts– applications of solubility product principle. Numerical Problems.	**9**

	Ref. No. 1: Pg. No. 706-742	
III	**Qualitative Analysis of Organic Compounds:** Types of organic compounds, characteristic tests and classifications, Tests for functional groups, analysis of binary mixtures, analysis and detection of nitrogen, sulfur, halogen and phosphorous by Lassiagen's test. Purification of Organic compounds: Introduction, recrystallization, distillation, sublimation. **Ref. No. 3: Pg. No. 16-46** **Ref. No. 4: Pg. No. 186-204, 216-244**	**7**
IV	**Chromatographic Techniques:** Introduction- Introduction to chromatography, IUPAC definition of chromatography. Paper chromatography, Thin Layer Chromatography, Ion exchange Chromatography, Gel permeation Chromatography, column chromatography, Gas chromatography, Classification of chromatographic methods – according to separation methods and development procedures. a. Thin Layer Chromatography: Theory and principles, outline of the method, surface adsorption and spot shape, Comparison of TLC with other forms of chromatography, adsorbents, preparation of plates, application of samples, development. b. Paper Chromatography- Origin, overview of technique, sample preparation, types of paper, solvents, equilibrium, development, sample application and detection, Identification, Quantitative methods, applications of paper chromatography **Ref. No. 5: Pg. No. 506-511, 517-525** **Ref. No. 6: Pg. No.135-138, 153-155, 169-171, 173-180**	**8**

Reference Books:

1. Puri, Sharma, Pathania, Principles of Physical Chemistry (47th Edition), Vishal Publishing Co.
2. N. B. Singh, S. S. Das, A.K. Singh, Physical Chemistry Vol-II, New Age Int. Publishers (2009)
3. Douglas A. Skoog, Donald M West, F. James Holler, Stainly R. Crounch, Fundamentals of Analytical Chemistry, 9th Edn.
4. Qualitative Organic Analysis, 4th Edn. by A. I. Vogel (ELBS)
5. G D Christian -Analytical Chemistry 5 th Edn.
6. David Harvey, Modern Analytical Chemistry, McGraw Hill Higher education

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Post Graduate Department of Chemistry and Research Center

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Offered as	**Major**
Course/ Paper Title	**Inorganic and Organic Chemistry II**
Course Code	**23SBCH22MM**
Semester	**II**
No. of Credits	**2 (30 Hrs)**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	Theories of Chemical Bonding and Shapes of Molecules
2.	Concepts in Stereochemistry

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	**Unit I: Chemical Bonding:** a) Attainment of stable electronic configurations. b) Define various types of chemical bonds- Ionic, covalent, coordinate and metallic bond. c) Explain characteristics of ionic bond, types of ions, energy consideration in ionic bonding, lattice and solvation energy and their importance in the context of stability and solubility of ionic compounds. d) Summarize Born-Lande equation and Born-Haber cycle, e) Define Fajan's rule, bond moment, dipole moment and percent ionic character. f) Describe VB approach, Hybridization with example of linear, trigonal, square planer, tetrahedral, TBP, and octahedral. g) Discuss assumption and

	need of VSEPR theory. h) Interpret concept of different types of valence shell electron pairs and their contribution in bonding. i) Application of non-bonded lone pairs in shape of molecule j) Basic understanding of geometry and effect of lone pairs with examples such as ClF3, Cl2O, BrF5, XeO3 and XeOF4
2.	**Unit II: Stereochemistry:** Conceptual understanding of Isomerism, Classification, Optical Activity, Stereochemistry of Cyclic Compounds, Problems based on Assignment of R/S and E/Z

Syllabus

Unit No.	Title with Contents	No. of Lectures
I	**Chemical Bonding:** Attainment of stable electronic configurations, Types of Chemical bonds: Ionic, covalent, coordinate and metallic bonds Ionic Bond: General characteristics of ionic bonding, Types of ions, Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, BornHaber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. Covalent bond: Valence Bond Approach, Hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. VSEPR theory, Assumptions, need of theory, application of theory to explain geometries of molecules such as i) ClF3ii) Cl2O iii) BrF5 iv) XeO3 v) XeOF4 vi) XeF6 vii) XeO2F2 **Ref. No. 1: Pages 35-51**	**15**
II	**Stereochemistry:** Stereochemistry: Introduction, classification, Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Conformations with respect to ethane, butane and cyclohexane. Configuration: Geometrical cis/trans and E/Z Nomenclature (for up to two C=C systems). Optical isomers, Enantiomers, Diastereomers and Meso compounds). Concept of chirality (upto two carbon atoms). Threo and Erythro; D and L nomenclature; CIP Rules: R/S (up to 2 chiral carbon atoms).	**15**

	Stereochemistry of Cyclic Compounds, Baeyer's Angle Strain Theory, Conformational isomers of cyclohexane and their energy. Isomerism in dimethyl cyclohexane. Examples of chiral drugs and significance of stereo chemically pure drugs. **Ref. No. 2: Pg. No. 115-141, 289-301** **Ref. No. 3: Pg. No. 3-11, 124-127, 204-207**	

Reference Books:

1. Cotton, F. A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
2. Organic Chemistry by Morrison & Boyd, 6 th Edn
3. Eliel, E. L. Stereochemistry of Carbon Compounds, Tata McGraw Hill Education, 2000

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Syllabus for F.Y.B.Sc. Chemistry

2023-24 (CBCS-Autonomy 23 Pattern)

Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Major**
Course/ Paper Title	**Practical Course in Chemistry-II**
Course Code	**23SBCH23MM**
Semester	**II**
No. of Credits	**2 (60 Hrs)**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	Principles of pH Metry and Application
2.	Inorganic Synthesis and Volumetric Analysis
3.	Application of Green Chemistry in Organic Synthesis
4.	Application of Paper Chromatography

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	Understanding of Principles of Ionic Equilibrium & pH Metry
2.	Skill development in carrying our Inorganic synthesis
3.	Understanding of principles of Green Chemistry and Applications
4.	Understanding of principles of Chromatography and Applications

Sr. No.	Title with Contents	Practical Session
	Section A: Physical Chemistry	
1.	**Ionic Equilibria (Any Three)** Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter	**1**
2.	Measurement of the pH of buffer solutions and comparison of the values with theoretical values	**1**
3.	Preparation of buffer solutions Sodium acetate-acetic acid and determine its buffer capacity	**1**
4.	Ammonium chloride-ammonium hydroxide and determine its buffer capacity	**1**
	Section B: Inorganic Chemistry	
5.	**Synthesis of commercially important inorganic compounds (Any Two)** Synthesis of potash alum from aluminum metal (scrap Aluminum metal)	**1**
6.	Synthesis of Mohr's Salt $[(FeSO_4)(NH_4)_2SO_4].6H_2O$	**1**
7.	Preparation of Dark red inorganic pigment: Cu_2O	**1**
8.	Synthesis of $FeSO_4.7H_2O$	**1**
9.	**Volumetric Analysis (Any Two)** Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.	**1**
10.	Determination of basicity of boric acid or oxalic acid or citric acid hence determination of their equivalent weight.	**1**
11.	Estimation of water of crystallization in Mohr's salt by titrating with KMnO4	**1**
12.	**To draw polar plots of s and p orbitals**	**1**
	Section C: Organic Chemistry	
13.	**Green Organic Preparations (Any Two)** Bromination of Cinnamic acid using sodium bromide and Sodium bromate	**1**
14.	Bromination of acetanilide using KBr and Cerric Ammonium Nitrate in aqueous medium	**1**
15.	Preparation of dibenzylidene acetone with LiOH.	**1**
	Section D: Analytical Chemistry	
16.	**Paper Chromatography (Any Two)** Separation of constituents of mixtures by Chromatography: Measure the Rf value in each case. Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acids) / pigments from plant extract / 2 organic compounds by paper chromatography	**1**
17.	Identify and separate the sugars present in the given mixture by paper Chromatography. [Combination of two compounds/plant extract to be given]	**1**

Reference Books:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education,2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson,2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition,1996.
4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman,1960.
5. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

N. B.:

1. Use molar concentrations for volumetric /estimations/synthesis experiments.
2. Use optimum concentrations and volumes.
3. Two burette method should be used for volumetric analysis (Homogeneous Mixtures)
4. Use of microscale technique is recommended wherever possible.

Note:

1. In synthesized compound student must confirm the particular cation and anion by performing qualitative tests.
2. Costing of product for 100 g pack can be calculated on the basis of cost of raw materials used and percent yield of the product.
3. Synthesized compounds should be collected from all students and stored properly. They should be used in other experiments such as Mohr's salt for determination of water of crystallization. Potash alum and $FeSO_4$ can be given in IQA experiments or for estimations at S.Y. and T.Y. level.

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Syllabus for F.Y.B.Sc. Chemistry

2023-24 (CBCS-Autonomy 23 Pattern)

Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Minor**
Course/ Paper Title	**Foundation Course in Chemistry I**
Course Code	**23SBCH21MN**
Semester	**II**
No. of Credits	**2 (30 Hrs)**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	The basic Mathematical skills required in Chemistry
2.	Principles and Basic Concepts of Stoichiometry,
3.	Periodicity of Elements
4.	Chemistry of Aliphatic Hydrocarbons

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	**Unit I: Chemical Mathematics** Fundamental principles of mathematics used in Chemistry for problem solving and calculations.
2.	**Unit II: Principles of Stoichiometry** Calculations of mole, molar concentrations and various units of concentrations which will be helpful for preparation of solution, calculations, expression and calculation of different concentration terms. SI units,

3.	**Unit III: Atomic Structure** a) Various theories and principles explaining atomic structure. b) Origin of quantum mechanics and its need to understand structure of hydrogen atom. c) Significance of quantum numbers d) Shapes of orbitals
4.	**Unit IV: Chemistry of Aliphatic Hydrocarbons** Aliphatic Hydrocarbons Mechanistic understanding of nature and reactivity of hydrocarbons. Application of various reactions to carry out interconversion between hydrocarbons.

Syllabus

Unit No.	Title with Contents	No. of Hours
I	**Chemical Mathematics:** Graph: Cartesian co-ordinates, plotting of graph from experimental data, equation of straight line, slope, Intercept & its characteristics. Derivative: Definition, Simple rules of differentiation partial differentiation, examples related to chemistry. Integration: Definition, Simple rules of Integration, Integration between limits, examples related to chemistry. **Ref. No. 1 Pg. No. 1-10** **Ref. No. 2 Pg. No. 3-27**	**08**
II	**Principles of Stoichiometry:** Units of measurements, SI units, distinction between mass and weight, mole, millimole and calculations, significant figures Solution and their concentrations: Molar concentrations, Molar analytical Concentrations, Molar equilibrium concentration, percent, concentration, part per million, part per billion, part per thousand, solution-dilatant volume ratio, functions, density and specific gravity of solutions, problem solving. Chemical Stoichiometry: Empirical and Molecular Formulas, Stoichiometric Calculations, Problem solving. **Ref. No. 3: Pg. No. 65-103** **Ref. No. 4: Pg. No. 259-260** **Ref. No. 5: Pg. No. 62-78**	**07**
III	**Atomic Structure:** Origin of Quantum Mechanics: Why study quantum mechanics? Quantum mechanics arose out of interplay of experiments and Theory Energy quantization- i) Black body radiation ii) The photoelectric effect iii) Wave particle duality a) The particle character of electromagnetic	**07**

	radiation b) the wave character of particle, iv) diffraction by double slit v) atomic spectra, Review of Bohr's theory and its limitations, Heisenberg Uncertainty principle. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). **Ref. No. 6: Pg. No. 1-38, 141-154**	
IV	**Chemistry of Aliphatic Hydrocarbons:** Functional group approach for the following reactions (preparations & reactions with mechanism) to be studied in context to their structure. 1. Alkanes: Preparation: Catalytic hydrogenation, Wurtz reaction, Reactions: Free radical Substitution: Halogenation. 2. Alkenes: Preparation: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's Rule); cis alkenes (Partial Catalytic Hydrogenation) and trans alkenes (Birch reduction), Reactions: Cis-addition (alk. $KMnO_4$) and trans addition (bromine), Addition of HX (Markownikoff's and anti Markownikoff's addition), 3. Alkynes: Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalide Reactions: formation of metal acetylides, addition of halogen and haloacid. **Ref. No. 7: Pg. No. 73-114,143-176,177-221, 250-262, 310-328, 337-341** **Ref. No. 8: Pg. No. 201-297, 677-684**	**08**

References

1. Puri, Sharma, Pathania, Principles of Physical Chemistry (47th Edition), Vishal Publishing Co.
2. R. L. Madan, Chemistry for Degree Students, as per UGC model Curriculum, S. Chand (2010)
3. G D Christian -Analytical Chemistry 5 th Edn.
4. Qualitative Organic Analysis, 4th Edn. by A. I. Vogel (ELBS)
5. Vogel's Quantitative Analysis, 5th Edn.
6. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
7. Organic Chemistry by Morrison & Boyd, 6 th Edn.
8. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010

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2023-24 (CBCS-Autonomy 23 Pattern)

Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Minor**
Course/ Paper Title	**Chemistry Practical in Fundamental Techniques I**
Course Code	**23SBCH22MN**
Semester	**II**
No. of Credits	**2 (30 Hrs)**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	Laboratory Safety and MSDS
2.	Practical application of Thermodynamic and Ionic Equilibrium
3.	Organic Purification and Organic Synthesis
4.	Tests for Food Adulteration

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	Understanding of importance of safety measures and precautions in laboratory
2.	Conceptual understanding of thermochemical parameters and related concepts.
3.	Significance of Green Chemistry
4.	Awareness of Food Adulteration and Methods of Detection
5.	Applications of Chromatographic techniques

Sr.	Title with Contents	Practical

No.		Session
	Section A: Chemical and Lab Safety (Any Three)	
20.	Toxicity of the compounds used in chemistry laboratory.	**1**
21.	Safety symbol on labels of pack of chemicals and its meaning	**1**
22.	What are MSDS sheets? Find out MSDS sheets of at least 2 hazardous chemicals ($K_2Cr_2O_7$, Benzene, cadmium nitrate and sodium metal)	**1**
23.	Precautions in handling of hazardous substances like Conc. acids, ammonia and organic solvents.	**1**
	Section B: Thermochemistry (Any Two)	
24.	Determination of heat capacity of calorimeter for different volumes.	**1**
25.	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.	**1**
26.	Determination of enthalpy of ionization of acetic acid.	**1**
	Section C: Organic Chemistry	
27.	**Green Organic Preparations (Any Two)** Bromination of Cinnamic acid using sodium bromide and Sodium bromate	**1**
28.	Bromination of acetanilide using KBr and Cerric Ammonium Nitrate in aqueous medium	**1**
29.	Preparation of dibenzylidene acetone with LiOH.	**1**
	Section D: Analytical Chemistry	
30.	**Tests for Food Adulteration (Any One) (As per DART defined by FSSAI)** Tests for Milk and Milk Products, Oils and Fats and Honey	**1**
31.	Tests for Salt, Spices & Condiments	**1**
32.	**Paper Chromatography (Any Two)** Separation of constituents of mixtures by Chromatography and Rf Measurement. Mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acids) Pigments from plant extract or Mixture of 02 organic compounds	**1**
33.	**Volumetric Analysis (Any Two)** Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.	**1**
34.	Determination of basicity of boric acid or oxalic acid or citric acid hence determination of their equivalent weight.	**1**
35.	Estimation of water of crystallization in Mohr's salt by titrating with KMnO4	**1**

Reference Books:

1. Systematic Experimental Physical Chemistry, S.W. Rajbhoj and T.K. Chondekar, Anjali Publication (2013).
2. Advanced Experimental Chemistry volume - I, J.N. Gurtu R. Kapoor, S. Chand and Co. New Delhi.
3. Experimental Physical Chemistry, V. D. Athawale, P. Mathur, New Age International Publishers.
4. Experimental Physical Chemistry, R. C. Das, B. Behara, Tata McGraw Hill Publishing Co. Ltd.
5. A Senior Practical Physical Chemistry, Khosla, B. D.; Garg, V. C. & Gulati, R. Chand & Co.: New Delhi (2011).
6. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
7. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Text book of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
8. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

9. Prof. Robert H. Hill Jr., David C. Finster Laboratory Safety for Chemistry Students, 2nd Edition Wiley ISBN: 978-1-119-02766-9 May 2016
10. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education,2012.
11. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

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Syllabus for Chemistry

2023-24 (CBCS-Autonomy 23 Pattern under NEP)

Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Open Elective (For other faculties)**
Course/ Paper Title	**Chemistry in Daily Life**
Course Code	**23SBCH1OE**
Semester	**I to VI**
No. of Credits	**2**

Sr. No.	Objectives
1.	To provide an insight into the applications and role of Chemistry in everyday life.
2.	To create awareness related to food products, associated synthetic additives and health concerns
3.	To provide the chemical perspective of various food products, vitamins and polymers to the students from other non-science faculties.

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	Understand and appreciate the role of Chemistry in daily life.
2.	Scientific perspective to look at food and objects with health awareness
3.	Understand the benefit and hazards of Chemicals

Syllabus

Unit	Content	Hours
I	**Dairy Products**: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages.	06
II	**Food Additives, Adulterants and Contaminants**: Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate. Flavours: Vanillin, alkyl esters (fruit flavors) and monosodium glutamate. **Artificial Food Colorants:** Coal tar dyes and non-permitted colours and metallic salts. Analysis of pesticide residues in food.	07
III	**Vitamins:** Classification and Nomenclature. Sources, deficiency diseases and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1 **Oils and Fats**: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils.	07
IV	**Polymers:** Types and classification of polymers. Source and general characteristics of natural and synthetic polymers. Typical examples of polymers used as plastics, in textiles, in electronic and automobile components, in the medical and aerospace materials. Problems of plastic waste	07
V	**Soaps & Detergents**: Definition, classification, composition and uses	03

References

1. Analysis of Foods – H.E. Cox
2. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998)
3. Introduction to Industrial Chemistry, Goel Publishing, B. K. Sharma: Meerut (1998)
4. Drugs and Pharmaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York
5. Handbook on Fertilizer Technology by Swaminathan and Goswamy, 6th ed. 2001, FAI.
6. Organic Chemistry by I. L. Finar, Vol. 1 & 2.
7. Polymer Science and Technology, J. R. Fired (Prentice Hall).

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Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Open Elective**
Course/ Paper Title	**Fundamentals of Food Safety**
Course Code	**23SBCH2OE**
Semester	**I to VI**
No. of Credits	**2**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	Basic understanding of Food Safety, Chemical and Biological Hazards
2.	The important guidelines of national and international laws on food safety
3.	Safety measures and strategies used in food processing plants

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	The understanding of Food Safety and associated hazards.
2.	Knowledge of pathogens, allergens, toxins, and chemical contaminants.
3.	Perception of Industrial Standards of Food Safety and Good Manufacturing practices in food processing plants.

Syllabus

Unit	Content	Hours
I	**Introduction to Food Safety:** Overview of food safety: Importance, historical perspective, and global significance. Food safety hazards: Biological, chemical, and physical hazards and their sources.	2
II	**Chemical and Physical Safety** Chemical hazards: Common chemical contaminants (e.g., pesticides, heavy metals, allergens), their sources, detection, and prevention measures. Food additives and preservatives: Types, regulations, and their impact on food safety. Physical hazards: Sources of physical contamination (e.g., glass, metal, foreign objects), prevention, and control methods.	5
III	**Microbiological Safety** Foodborne pathogens: Common bacteria, viruses, parasites, and their characteristics. Microbial growth and control: Factors affecting microbial growth, prevention, and control methods (temperature control, pH, preservatives) and emerging technologies in controlling biological contamination.	8
IV	**National and International Food Safety Regulation:** Salient features of international and national regulations, such as FDA Food Safety Modernization Act (FSMA) and FSS Act 2006	5
V	**Safety Protocols in Food Processing Units** Good Manufacturing Practices (GMP), Sanitation and Cleaning, Pest Control, HACCP (Hazard Analysis and Critical Control Points), Temperature Control, Employee Training and Hygiene, Supplier Verification, Quality Assurance and Testing, Documentation and Record-Keeping.	10

References:

1. Food Safety Handbook, Ronald H. Schmidt and Gary E. Rodrick, John Wiley & Sons Publication, Chapter 1, 2 and 8,9, 10, 13, 14, 21, 22, 23, 25
2. Food Safety and Standards Act, 2006
3. FDA Food Safety Modernization Act (FSMA)

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Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Vocational Skill Course**
Course/ Paper Title	**Chemistry Laboratory Techniques**
Course Code	**23SBCH1VS**
Semester	**I-VI**
No. of Credits	**2 (60 Hrs)**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	Basic Skill required in Chemistry Practical
2.	Calculations and significance of molar quantities
3.	Uses of Simple Electrochemical Experiments
4.	Scope of Advance Instrumental Techniques

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	Understanding of importance of safety measures and precautions in laboratory. Handling of Chemicals and Preparation of Solutions of various concentration by Calculations and Purification Techniques
2.	Conceptual understanding of thermochemical parameters and related concepts.
3.	Preparation of buffer solutions and significance of electrochemical principles in chemical analysis
4.	Perception of the wide scope of applications of Analytical Instruments and related job opportunities.

Syllabus

Sr. No.	Title with Contents	Practical Session
Fundamental Techniques in Chemistry Laboratory		
1.	Safety Measures in Chemistry Laboratory	1
2.	Preparation of Common Laboratory Solution	1
3.	Errors in Quantitative Analysis	1
4.	Volumetric Techniques Estimation of acetic acid from vinegar	1
5.	Sublimation Naphthalene and Sulphur	1
6.	Crystallization Benzoic Acid and Acetanilide	1
7.	Melting Point Determination Organic Solid Compounds Benzoic Acid, o and p nitroaniline	1
8.	Distillation Microscale separation of Volatile and Non-Volatile Liquids Acetone Chloroform Aniline Diethylmalonate	1
9.	Paper Chromatography Separation of Metal Ions and Identification	1
Techniques in Synthesis		
10.	Requirements of Chemical Synthesis	1
11.	Reaction Work-up I: Extracting, Washing and Drying	1
12.	Basics of TLC	1
13.	Column Chromatography	1
Solution and Electrochemistry		
14.	Making Buffers and Using a pH Meter	1
15.	Conductometric Titration	1
Advance Purification Techniques (Demonstrations)		
16.	GC	1
17.	HPLC	1
18.	Flash Column Chromatography	1

References

12. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Text book of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
13. Systematic Experimental Physical Chemistry, S.W. Rajbhoj and T.K. Chondekar, Anjali Publication (2013).
14. Experimental Physical Chemistry, R. C. Das, B. Behara, Tata McGraw Hill Publishing Co. Ltd.
15. T.Y.B.Sc. Practical Handbook, Fifth and Sixth Semester, Manali Prakashan
16. Manual and SOP of the models of GC, HPLC and Flash Column available in Department

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Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Vocational Skill Course**
Course/ Paper Title	**Computer-Aided Drug Design and Discovery**
Course Code	**23SBCH2VS**
Semester	**III-VI**
No. of Credits	**2**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	The concept of Computer Aided Drug Design and Discovery
2.	The strategies used by industries and research labs in the process of CADDD.
3.	The significance of various descriptors of Drug likeness and ADMET
4.	The applications and software used in CADDD
5.	The skills in determining drug targets and Ligand-Protein Interaction and binding affinities.

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	Understand the Concept of Computer Aided Drug Design and Discovery
2.	Perceive Scientific Approach and Modern Tools used in CADDD
3.	Develops skills in Operating various Computer Applications
4.	Carry out independent work to complete given tasks in CADDD
5.	Understand the prospects of CADDD in higher education, research and jobs..

Syllabus

Unit	Content with Title	Hours
I	**Introduction to Computer Aided Drug Design (CADDD)** What is Computer Aided Drug Design (CADDD)? History of CADDD, Applications of CADDD, Challenges in CADDD	5
II	**Methods of Computer Aided Drug Design** Structure-based drug design (SBDD), Ligand-based drug design (LBDD), Virtual screening, Molecular dynamics simulations, Pharmacokinetics (PK) and pharmacodynamics (PD) modeling	9
III	**Software and Applications used in CADDD** KingDraw (Android), Marvin Sketch, ChemDraw, Discovery Studio, AutoDock, Pymol	18
IV	**Pharmacokinetics, Drug Likeness and Target Prediction of small molecules** Online tools to predict ADMET parameters like Swiss ADMET, Swiss Target, Lipinsky Rule of Five, Testing of theoretical structures for Drug Likeness	10
V	**Molecular Docking Protein-Ligand Interaction** Case Study: Imatinib and Project Work	18

References:

1. Vemula D, Jayasurya P, Sushmitha V, Kumar YN, Bhandari V. CADD, AI and ML in drug discovery: A comprehensive review. Eur J Pharm Sci. 2023 Feb 1;181:106324. doi: 10.1016/j.ejps.2022.106324. Epub 2022 Nov 5. PMID: 36347444.
2. Wang A, Durrant JD. Open-Source Browser-Based Tools for Structure-Based Computer-Aided Drug Discovery. Molecules. 2022 Jul 20;27(14):4623. doi: 10.3390/molecules27144623. PMID: 35889494; PMCID: PMC9319651.
3. Leelananda SP, Lindert S. Computational methods in drug discovery. Beilstein J Org Chem. 2016 Dec 12;12:2694-2718. doi: 10.3762/bjoc.12.267. PMID: 28144341; PMCID: PMC5238551.
4. Protocols by instructor and Software Manual

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Syllabus for Chemistry

2023-24 (CBCS-Autonomy 23 Pattern under NEP)

Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Skill Enhancement Course (SEC)**
Course/ Paper Title	**Food Safety and Quality Management**
Course Code	**23SBCHSE**
Semester	**I to VI**
No. of Credits	**2**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	The principles and practices ensuring the safety and quality of food throughout the entire food supply chain.
2.	The various types of biological, chemical, and physical hazards
3.	The Rules and Acts on Food Safety
4.	Standards related to food quality and easy and fast tests
5.	The simple experiments to test various food products.

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	The understanding of Food Safety and associated hazards.
2.	Knowledge of foodborne pathogens, allergens, toxins, and contaminants.
3.	Familiarity with the design, implementation, and management of food safety systems.
4.	Knowledge and skills necessary for ensuring food quality through simple experiments.
5.	Self-awareness about food safety and promotion of the idea of food safety in the community.

Syllabus

Unit	Content	Hours
I	**Introduction to Food Safety:** Definition, Principles of safe food, Processes for making food safe, Factors compromising the food safety, Need and importance of safe food.	2
II	**Characterization of Food Hazards:** Physical, Chemical and Microbial Contamination, sources of biological contamination, chemical and physical hazards produced during food processing, storage, and preparation	5
III	**Regulatory Affairs in Food Safety: FSS Act 2006** Food Hygiene, Integrated approach to Food Hygiene and Safety, Food Safety and Hygiene Requirements, General Requirements on Hygienic and Sanitary Practices, Location and Surroundings, Layout and Design of Food Establishment Premises, Equipment & Containers, Facilities, Food Operations and Controls, Management and Supervision	5
IV	**Determination of Basic Parameters of Food Quality:** Determination of moisture in food products by hot air oven-drying method Determination of total ash content in food products Determination of pH of food products by using pH meter Determination of specific gravity of oils and fats	8
V	**Food Quality Testing Protocols to Detect Adulteration (Rapid Test by FSSAI)** Testing of Milk Testing of Oil and Fats Testing of Honey Testing of Food Grains Testing of Spices like pepper, chilli powder, iodized salt, asafoetida (Hing)	10

References:

1. Food Safety Handbook, Ronald H. Schmidt and Gary E. Rodrick, John Wiley & Sons Publication, Chapter 1, 2 and 8 and 13
2. Food Safety and Standards Act, 2006
3. IGNOU Practical Manual for Food Safety Course
4. FSSAI DART Book

M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

Syllabus for Phytochemistry of Indian Medicinal Plants

2023-24 (CBCS-Autonomy 23 Pattern)

Board of Studies (Chemistry)

Post Graduate Department of Chemistry and Research Center

Abeda Inamdar Senior College of Arts, Science and Commerce, Pune-411001

Offered as	**Indian Knowledge System (IKS)**
Course/ Paper Title	**Phytochemistry of Indian Medicinal Plants**
Course Code	**23SBCH51IK**
Semester	**I**
No. of Credits	**2 (30 hrs)**

Aims & Objectives of the Course: The student should learn:

Sr. No.	Objectives
1.	The significance of Medicinal Plants, Classical System of Indian Medicines like Ayurveda, Siddha and Unani
2.	The broader idea about various class of organic compounds found in plants of medicinal value and details of their extraction and purification
3.	The medicinal importance of three major medicinal plants of Indian origin viz. Neem (*Azadirachta indica*), Tulsi (*Ocimum sanctum*), Turmeric (*Curcuma longa*)
4.	The prevalent practices about conservation and propagation of Indian Medicinal plants, Screening of phytochemicals and Regulatory Guidelines

Expected Course Specific Learning Outcomes

Unit No.	Learning Outcome
I	The students will have enough knowledge about the Indian Medicinal Plants, and the significant role of Classical System of Indian Medicines like Ayurveda, Siddha and Unani in the modern-day Medicinal Chemistry
II	The student will get the idea about various class of organic compounds found in plants of medicinal value and details of their extraction and purification
III	The student will be able to realize the medicinal importance of Indian Medicinal plants through three cases studies of medicinal plants of Indian origin viz. Neem (*Azadirachta indica*), Tulsi (*Ocimum sanctum*), Turmeric (*Curcuma longa*)
IV	The student will become familiar with the process of conservation and propagation of Indian Medicinal plants, Screening of phytochemicals and Regulatory Guidelines

Syllabus

Unit No.	Title with Contents	No. of Hours
I	**Introduction to Phytochemistry and Medicinal Plants** Definition and importance of phytochemistry in the study of medicinal plants, chemical components present in plants. Traditional Knowledge of Indian Medicinal Plants, Introduction to the traditional systems of medicine in India (Ayurveda, Siddha, Unani), historical use of medicinal plants. The role of chemical tests in detecting specific phytochemicals, basic extraction and separation techniques. **Ref. No. 1, Ref. No. 2**	**6**
II	**Bioactive Compounds in Indian Medicinal Plants** Major classes of bioactive compounds (quinones, Phenolic, alkaloids, flavonoids, terpenoids etc.). Examples of bioactive compounds found in Indian medicinal plants. Extraction methods used to isolate bioactive	**8**

	compounds, simple separation techniques such as solvent extraction and chromatographic separation. Screening methods used to evaluate the effectiveness of plant extracts, antimicrobial and anticancer screening. Pharmacological properties of bioactive compounds, Examples of medicinal plants and their bioactive compounds with therapeutic applications, Role of Bioactive Compounds in Traditional Medicine, how bioactive compounds contribute to the effectiveness of traditional medicine. **Ref. No. 3, Ref. No. 4**	
III	**Medicinal Plants of India:** Medicinal Plants of India, Overview and Significance, the diversity and significance of medicinal plants in India, the cultural and traditional importance of Indian medicinal plants. Example of Neem (Azadirachta indica), its therapeutic properties, the bioactive compounds present in Neem and their applications, Tulsi (Ocimum sanctum), its medicinal uses, the bioactive compounds found in Tulsi and their health benefits, Turmeric (Curcuma longa), its medicinal properties, the bioactive compound curcumin and its pharmacological activities. **Ref. No. 5, Ref. No. 6**	**8**
IV	**Current Trends and Future Prospects** Sustainable practices in the harvesting and cultivation of medicinal plants, conservation strategies and the role of ethical sourcing. The use of phytochemicals in drug discovery, screening methods and approaches for identifying potential drug candidates, Approaches in Phytochemistry, Regulatory frameworks and guidelines for herbal products. **Ref. No. 7, Ref. No. 8**	**8**

References:

1. "Phytochemistry: Principles and Practice" by Valerie B. Thomas and Rochelle G. Williams.
2. "Medicinal Plants: Chemistry, Biology and Omics" edited by Joaquín Isac-García, Ana María González-Paramás, and Ana Isabel García-Mina.
3. "Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis" by Jeffrey B. Harborne.
4. "Phytochemical Analysis: A Guide to Techniques and Instrumentation" edited by Inamuddin, Mohammad

Asif, and Ali Mohammad.

5. "Handbook of Medicinal Plants" by Zohara Yaniv and Uriel Bachrach.
6. "Indian Medicinal Plants: An Illustrated Dictionary" by C.P. Khare.
7. "Phytochemistry: Advances in Research" edited by José-Luis Ríos and Hesham R. El-Seedi.
8. "Phytochemistry and Medicinal Plants: Recent Advances and Future Prospects" edited by Pratibha Chaturvedi and Pramod K. Sahu

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