

F.Y.B.Sc Credit Structure (NEP)

P.E.S's Modern College of Arts, Science and Commerce, Ganeshkhind, Pune-16 Autonomous
Syllabus 2023 Pattern

College Ganeshkhind Structure of Four Year Degree Programme

Credits related to Major					Minor	OE	SEC	AE
Mandatory	Elective	VSC	IKS	FP / CEP / OJT				
V-1	V-1	V-4	V-5	V-6	V-2	V-3	V-4	V-
4 (T) +2 (P) CHE11101: Fundamentals of Chemistry(4C) CHE11102: Introductory Laboratory course (2C)	0	2 (T) CHE11401: Making of soaps, detergents (2C)	2 (T) IKS11501: Foundation Course on IKS (2C)	0	2 (T) CHE11201: Fundamental Biochemistry-I	2 (T)+ 2 P CHE11301: Making of soaps, detergents and perfumes(2T)	2 (T/P) CHE11402: Preparation of solutions(2P)	2 (T)
4 (T) +2 (P) CHE12101: General Chemistry (4C) CHE12102: Analytical Laboratory Techniques-I (2C)	0	2 (T) CHE12401: Chromatographic techniques (2C)	0	0	2T CHE12201 Fundamental Biochemistry-II	2(T) + 2P CHE12301: Food Adultration(2T)	2 (T/P) CHE12402: Basic Analytical Techniques (2P)	2 (T)
12	0	4	2	0	2	8	4	4

**Progressive Education Society's Modern College of Arts, Science and Commerce, Ganeshkhind,
Pune-411016 (NEP Autonomous)
Syllabus F.Y. B.Sc Chemistry**

**SEMESTER-I
Major Chemistry**

CHE-11101: Fundamentals of Chemistry

(4 Credits 60 Lectures)

Unit	Chapters	Lectures
I	Chapter 1: States of Matter	10
	Chapter 2: Ionic Equilibria	10
II	Chapter-3: Periodic table and Periodicity of Elements	10
	Chapter 4: Chemistry of s-block and Noble gases	10
III	Chapter 5: Fundamentals of Organic Chemistry	10
	Chapter 6: Chemistry of Hydrocarbons	10
	Total	60

Course Outcomes:

CO 1: Students should be able to understand the concept of real and ideal gases.

CO 2: Student should understand the concept of ionization process in acids and bases.

CO3: Students will learn Periodicity of elements and modern periodic law.

CO4: Application of s-block elements

CO5: Students will be able to give the IUPAC nomenclature of organic compounds for mono functional groups and draw structures.

CO 6: Student should understand the fundamental concepts which govern the structure and bonding of organic molecules.

Unit I

Chapter 1: States of Matter

[10 L]

Introduction: States of matter and their properties. Gaseous states: Significance of ideal and kinetic gas equation (no derivation), Real gases Compressibility factor, Van der Waal's equation of state. Liquid state – Properties of liquids, Comparison between gaseous and solid states – Experimental determination of vapor pressure by isoteniscope method and viscosity by Ostwald method, liquid crystals and their applications.

Learning Outcomes:

- Student should understand the behavior of gases.
- Student should be able to solve problems regarding Van der Waal's equation and Critical constant and regarding P-V-T relations.

Chapter 2: Ionic Equilibria

[10L]

Ionic Equilibria of 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.

Learning Outcomes:

- Students should understand the concepts of common ion effect and its applications.
- Students will be able to solve the numerical problems on degree of hydrolysis and pH for different salts, buffer solutions.

References:

1. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
2. B S Bahl, G D Tuli, Arun Bahl, Essentials of Physical Chemistry

Unit II

Chapter-3: Periodic table and Periodicity of Elements

[10L]

Periodic table: Periodic table after 150 years, 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 e) Ionization energies f) Electronegativity, Pauling's / electronegativity scale

g) Oxidation states of elements.

Learning Outcomes:

Students should learn the properties with respect to-

- Effective nuclear charge, shielding or screening effect; some numerical problems.
- Atomic and ionic size, crystal, and covalent radii.
- Ionization energies.
- Electronegativity- definition, trend, Pauling electronegativity scale.
- Oxidation states of elements.

Chapter 4: Chemistry of s-block and Noble gases

[10L]

Special position of hydrogen in the long form of the periodic table, Properties of s-block elements w.r.t. electronic configuration, extraction, trends and properties, Introduction to crown ethers and cryptons, separation of s-block elements using crown ethers, Compounds of s-block elements: oxides, hydroxides, peroxides, super oxides, Application of s-block elements in industrial, biological, and agricultural fields. Position of noble gas elements in periodic table, Electronic configuration, Chemical Properties of Noble Gases, Chemistry of Xenon structure and bonding in Xenon compounds - XeF_2 , XeF_4 , XeO_6 , XeO_4 , XeO_2F_2 , $[\text{XeO}_6]^{4-}$, XeOF_4

Learning Outcomes:

- i) Students should know electronic configuration of s block elements
- ii) Chemical properties of s-block

References:

1. Concise Inorganic Chemistry by J.D. Lee 5th Edn.
2. Inorganic Chemistry Principles of structure & reactivity by James, Huheey, Keiter (Pearson Education)
3. Basic Inorganic Chemistry, Cotton, F.A., Wilkinson, G. & Gaus, P.L. 3rd Edn., Wiley

Unit III

Chapter 5: Fundamentals of Organic Chemistry:

[10L]

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape, and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.

Learning Outcomes:

- Student should understand the fundamental concepts which govern the structure and bonding of organic molecules.
- Student should understand the properties and reactivities of organic compounds.
- Students will be able to distinguish the different reactive intermediates of organic compounds.

Chapter 6: Chemistry of Hydrocarbons:

[10L]

Alkanes: IUPAC Nomenclature of alkane, Preparation methods of alkanes: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, and Grignard reaction. Reactions of alkanes: Free radical Substitution: Halogenation.

Alkenes: IUPAC Nomenclature of alkene, Preparation methods of alkenes: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions of alkenes: cis-addition (alk. KMnO_4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration- demercuration, Hydroboration-oxidation.

Alkynes: IUPAC Nomenclature of alkynes, Preparation methods of alkynes: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetrahalides and dehydrohalogenation of vicinal dihalides. Reactions of alkynes: formation of metal acetylides, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alkaline KMnO_4 .

Learning Outcomes:

- Students will be able to give the IUPAC nomenclature of organic compounds for monofunctional groups and draw structures.
- Students will be able to predict the conversion of one functional group into other functional group

References:

1. A guidebook to Mechanism in Organic Chemistry by Peter Sykes, 6th Edition.
 2. Organic Chemistry by Morrison & Boyd, 6th Edition
 3. Organic Chemistry by J. Clayden, Warren *et al*
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SEMESTER-I
Major (Practical Course)

CHE-11102: Introductory Laboratory course (2 Credits 30 Lectures)

Course Outcomes:

CO 1: Importance of chemical safety and Lab safety while performing experiments in the laboratory.

CO 2: Students will be able to prepare solutions of different concentrations.

CO3: Students will be able to understand the techniques of pH measurements.

CO4: Students will be able to understand the techniques of purification of organic compounds.

Section A: Chemical and Lab Safety (Compulsory)

- A) a) Toxicity of the compounds used in chemistry laboratory.
b) Safety symbol on labels of pack of chemicals and its meaning
c) What is MSDS sheets? Find out MSDS sheets of at least hazardous chemicals ($K_2Cr_2O_7$, Benzene, cadmium nitrate, sodium metal etc.)
d) Precautions in handling of hazardous substances like conc. acids, ammonia, organic solvents, etc.

Section B: Physical and Inorganic (Any Four)

- a) To prepare solutions of given concentrations.
b) To standardize the given NaOH solution and find strength of HCl.
c) To determine the gas constant R an expression of it in different units by Eudiometric method..
d) To determine strength of $KMnO_4$.
e) Inorganic qualitative analysis (only acidic radicals)

Section C: Analytical and Organic (Any Four) each analysis to be considered as one experiment.

- a) Purification Technique: Crystallization of organic compound from water.
b) Purification Technique: Distillation of organic.
c) Purification by sublimation
d) 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.
e) Type determination of organic compound. (single compound)

References:

1. Qualitative Inorganic Analysis, Svehla, G. Vogel's Pearson Education.
2. Quantitative Chemical Analysis, Mendham, J. Vogel's Pearson.
3. Text book of Practical Organic Chemistry, Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G. Prentice-Hall, 5th edition.

SEMESTER-II

Major

CHE-12101: General Chemistry

(4 Credits 60 Lectures)

Unit	Chapters	Lectures
I	Chapter 1: Atomic Structure	10
	Chapter 2 : Thermodynamics	10
II	Chapter-3: Chemical bonding	10
	Chapter-4: Hybridization of Orbitals	10
III	Chapter -5: Stereochemistry of acyclic organic compounds	10
	Chapter -6 Introduction to Aromaticity	10
	Total	60

Course Outcomes:

CO1: Students will be able to understand theories related to atomic structure.

CO2: Students will be able to apply thermodynamic principles to physical and chemical processes.

CO3: Students should understand basic principles of overlapping of atomic orbitals with specific shapes and size.

CO4: Students will be able to learn various theories for chemical bonding and applications of hybridization.

CO5: Students will be able to Apply Huckel's rule to different organic compounds to find out aromatic /non aromatic characters

Unit IV

Chapter 1: Atomic Structure

[10 L]

Introduction, atomic spectrum of hydrogen, Bohr model of hydrogen atom- derivation of atomic radius and energy, energy level diagram of hydrogen atom, Failure of Classical mechanics- black body radiation, photoelectric effect, electron diffraction, atomic spectra, quantization of energy, de Broglie's hypothesis.

Learning Outcomes:

- Students should understand the concept of black body radiation and photoelectric effect.
- Student will be able to understand the concept of quantization of energy and duality of matter.

Chapter 2 : Thermodynamics

[10L]

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.

Learning Outcomes:

- Calculations of enthalpy, Bond energy, Bond dissociation energy, resonance energy
- Natural changes are understood with the help of the second law of thermodynamics.
- Understand the application of thermodynamics.

References:

1. University General Chemistry. By C.N. R. Rao. Mc Millan Publication.
2. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH Publication.
3. Physical Chemistry. By G.M. Barrow.

Unit V

Chapter-3: Chemical bonding

[10 L]

Attainment of stable configuration, Types of bonds ionic, covalent, co-ordinate and metallic, Types of overlaps: s-s, p-p, s-p, p-d, d-d and their examples, Formation of sigma and pi bonds, Theories of bonding- a) Valence Bond Theory, b) Heitler London Theory and c) Pauling Slater Theory, Concept of hybridization: Definition and need of hybridization, steps involved in hybridization, explanation of covalency of atoms in the moles based on hybridization, types of hybridization involving s, p and d orbitals.

Learning Outcomes:

- Students should understand basic principles of overlapping of atomic orbitals with specific shapes and size.
- Students will be able to learn various theories for chemical bonding and applications of hybridization.

Chapter-4 Hybridization of Orbitals

[10 L]

Applications of hybridization: Geometries of molecules by making 3-D models viz:-BeH₂ ii) BF₃ iii) [MnCl₄]²⁻ iv) [Ni(CN)₄]²⁻ v) Fe(CO)₅

VSEPR theory: Assumptions, need of theory, application of theory to explain geometry of irregular molecules by making 3D models of molecules like -ClF₃ ii) Cl₂O iii) XeO₃ iv) XeOF₄

Learning Outcomes:

- Student will be able to learn various geometries of molecules by making their 3D models.
- Student should be able to explain the concept of hybridization and differentiation with overlap.

References:

1. Concise Inorganic Chemistry by J.D. Lee 5th Edn.
2. Basic Inorganic Chemistry by Cotton & Wilkison.
3. New guide to Modern Valence Theory By G.I. Brown

Unit VI

Chapter-5 : Stereochemistry of acyclic organic compound

[10 L]

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 upto two C=C systems). Optical isomerism Enantiomerism, Diastereomerism and Meso compounds). Concept of chirality (upto two carbon atoms). Threo and erythro; D and L; nomenclature; CIP Rules: R/ S (for upto 1 Chiral carbon atoms)

Learning Outcomes:

Students will understand

1. Concept of isomerism, types of isomers and representation of organic molecules.
2. Conformational isomerism in alkanes with energy profile diagram.
3. Concept of geometrical isomerism with E/Z nomenclature.
4. Understanding of optical activity, isomer number, tetrahedral carbon atom, concept of chirality, enantiomers, R/S nomenclature for single chiral Centre.

Chapter-6: Introduction to Aromaticity. [10 L]

1. Hückel's rule, Examples of monocyclic, polycyclic and heterocyclic systems.
2. Aromatic stability of benzene
3. Orientation of unsubstituted benzene towards electrophilic substitution for example nitration and sulphonation.

Learning Outcomes:

- Application of Huckel's rule to different organic compounds to find out aromatic/non aromatic characters.
- Students should know concept of electrophilic of substituted reaction.

References:

1. Organic Chemistry by Clayden, Oxford university press.
2. Organic Chemistry by Morrison & Boyd, 6th Edition.
3. Stereochemistry of carbon compounds by E.L

SEMESTER-II

Major (Practical Course)

CHE-12102: Analytical and Organic Technique (2 Credits 30 Lectures)

Course Outcomes:

CO1: The practical course is in relevance to the theory courses to improve the understanding of the concepts.

CO2 : It would help in development of practical skills of the students.

CO3: The student will be able to design the experiments by their own innovative ideas through experiential learning experiments and projects.

CO4: The student will be able analysed organic and

Section A: Volumetric Analysis (Anyone)

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in the mixture
2. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .

Section B: Physical and Analytical Chemistry (Any Three)

4. Determination of heat capacity of calorimeter for different volumes.
5. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
6. Study of the solubility of benzoic acid in water and determination of ΔH .
7. Purification Technique: Sublimation

Section C: Organic and Inorganic Chemistry (Any Four) Each analysis is to be considered as one experiment.

8. Organic Qualitative Analysis (Element detection and physical constant)-Any 2 compounds (**V-Lab Practical**)
9. Bromination of acetanilide using KBr and Ceric ammonium nitrate in aqueous medium. (Green Chemistry Approach)
10. Semi carbazone derivative of aldehyde or ketone
12. Inorganic Qualitative Analysis- one acidic radical and one basic radical (Two salts)

Section D: Experiential Learning Experiments (Any three)

13. To determine amount of acetic acid in commercial vinegar.
14. Separation of constituents of mixtures by Chromatography: Measure the R_f value in each case (Two mixtures).
 15. Identify and separate the components of the sample collected by students (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acids) / pigments from plant extract.
16. To study applications of elements (any two) / compounds (any two) used in day to day life. OR
17. Project / Survey / Field Visit Report (Consider 4 practical)

References:

1. Qualitative Inorganic Analysis, Svehla, G. Vogel's Pearson Education.
2. Quantitative Chemical Analysis, Mendham, J. Vogel's Pearson.
3. Text book of Practical Organic Chemistry, Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G. Prentice-Hall, 5th edition.

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**Progressive Education Society's Modern College of Arts, Science and Commerce, Ganeshkhind,
Pune-411016 (NEP Autonomous)**

SEMESTER-I

F.Y. B.Sc (Minor Chemistry)

CHE-11201: Fundamentals of Biochemistry-1 (2 Credits 30 Lectures)

Sr. No.	Chapters	Lectures
1	Chapter-1: Bonding in Biomolecules	10
2	Chapter 2: Carbohydrates and its stereochemistry	10
3	Chapter-3: Lipids	10
	Total	30

Course Outcomes:

CO 1: Students will be able to know basic concepts of biomolecules.

CO 2: Students will be able to draw different structure of carbohydrates and reactions of carbohydrates.

CO 3: The students will understand structures and chemistry of lipids.

Chapter-1: Bonding in Biomolecules**[10L]**

Peptide Bond, Hydrophobic Bonds, Disulfide Bonds, Phosphodiester Bonds, Hydrogen Bonds, Glycosidic Bonds.

Learning Outcome:

Students will be able to understand bonding linkages in biomolecules.

Chapter 2: Carbohydrates and its stereochemistry**[10L]**

Classification, Structure and Biological Significance of Carbohydrates, Structural Representation of Monosaccharide, Structure of Maltose, Cellobiose, Lactose, Amylose, Amylopectin and Cellulose.

Learning Outcomes:

- Students will be able to draw structures of biomolecules.
- Students should understand stereochemistry glucose.
- Students will be able to convert structures of glucose in different forms
- Students should understand the reactions of glucose.

Chapter-3: Lipids**[10L]**

Classification, Short hand representation of unsaturated fatty acids, Structural representation of Lipids, mechanism of lipid in biosynthesis, Biological significance of Lipids

Learning Outcomes:

- The student will be able to become aware of the types of lipids, structure of lipids and properties of lipids.

SEMESTER-II
F.Y. B.Sc (Minor Chemistry)

CHE-12201: Fundamental of Biochemistry-II (2 Credits 30 Lectures)

Sr. No.	Chapters	Lectures
1	Chapter-1: Concept of Amino acids	10
2	Chapter-2: Reactions of amino acid	10
3	Chapter-3: Peptide bonds and Proteins.	10
	Total	30

Course Outcomes:

CO 1: The student will understand the structures and types of amino acids.

CO 2: The student will understand the important reaction of amino acids.

CO 3: The student will understand the significance of amino acids.

CO 4: Structural features in proteins.

Chapter-1: Concept of Amino acids

[10 L]

Classification of amino acids. Concept of ampholytes, isoelectric pH, zwitter ions, titration curve of glycine.

Learning Outcome:

- The student will understand the structure and types of amino acids.
- Students will be able to know the importance and classification of amino acid.
- Students will be able to draw structures of amino acid and basic terms of amino acids.

Chapter-2: Reactions of amino acid

[10L]

Reactions of amino acid with Ninhydrin, Sanger's, Dansyl chloride, Dabsyl chloride and Edmann's reagents and their significance.

Learning Outcome:

- Students should understand the reaction of amino acid.

Chapter-3: Peptide bonds and Proteins.

[10 L]

Peptide bond formation. Types of proteins. Structural features in proteins. Effect of pH on structure of amino acid, Determination of N and C terminus of peptide chain.

Learning Outcome:

- Students will be able to understand Peptide bond formation.
- The student will be able to write structures of proteins with identification of N and C terminus of peptide chain.

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Syllabus 2023 Pattern**

**Progressive Education Society's Modern College of Arts, Science and Commerce, Ganeshkhind,
Pune-411016 (NEP Autonomous)**

SEMESTER-I

Major (VSC)

CHE-11401: Making of Soap (2 Credits 30 Lectures/Practicals)

Course Outcomes:

CO 1: Students will be able to learn to make soaps from soap base and different oils.

CO 2: Students will be able to develop skills to make specialty soaps with minimum range of oils, colors and fragrance.

CO 3: Students will be able to know about the history and economy of the soap industry.

CO 4: Students will be able to know how to create the recipe and brand of soap.

1. Experiment 1: History of Soap (Theoretical)
2. Experiment 2: World and Indian economy of soap (Theoretical)
3. Experiment 3: Methods of preparation of soap. (Homemade, Herbal and Industrial) (Theoretical)
4. Experiment 4: Soap making from base (Practical)
5. Experiment 5: Soap making from oil (Practical)
6. Experiment 6: Herbal soap making (Practical)
7. Experiment 7: Soap making from natural fragrance and pigment (Practical)
8. Experiment 8: Testing of soap made in laboratory (Practical)
9. Experiment 9: Testing of branded soap and Lab made soap and compare result. (Practical)
10. Experiment 10: Design procedure making of soap as per standard parameters of PH, oil interaction, foam and moisture. (Practical)
11. Experiment 11: Set up the procedure of soap making. (Practical)
12. Experiment 12: Project on survey of soap Industry (Theoretical)

SEMESTER-II
Major (VSC)

CHE-12401: Chromatographic Technique

(2 Credits 30 Lectures)

Sr. No.	Chapters	Lectures
1	Chapter 1: Introduction to analytical chemistry	10
2	Chapter 2: Qualitative Analysis of Organic and Inorganic compound Compounds	10
3	Chapter 3: Chromatographic Techniques –Paper and Thin Layer Chromatography	10
	Total	30

Course Outcomes:

CO1: Students will be understand the perspectives of Analytical Chemistry.

CO2: Students will be able to prepare the solutions of different concentrations.

CO3: Students should be able to identify the process to be utilized for chemical analysis.

Chapter 1: Introduction to analytical chemistry

[10 L]

What is analytical Chemistry, the analytical perspectives and Common analytical problems. Some important units of measurements-SI units, distinction between mass and weight, mole, millimole and calculations and significant figures. Chemical Stoichiometry – Empirical and Molecular Formulae, Stoichiometric Calculations, Problems. Mole concepts and Stoichiometry 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 and problems.

Learning Outcome:

- Students should understand the basic concepts of Analytical Chemistry.
- Students will be able to do the calculations of moles, molar concentrations and conversion of various units of concentrations.
- Students will be able to understand the concept of Normality, Molarity,
- Students should understand Molality, Normal solution, Molar solution, equivalent weight, ppm, and % w/v and % v/v.

Chapter 2: Qualitative Analysis of Organic and Inorganic compound Compounds [10 L]

Types of organic compounds, characteristic tests and classifications, reactions of different functional groups, analysis of binary mixtures. Analysis – Detection of nitrogen, sulfur, halogen and phosphorus by Lassaigne test. Purification of organic compounds- Introduction, recrystallization, distillation, sublimation. Analysis of acidic and basic radicals

Learning Outcomes:

- Students should be able to understand the Classification of organic compounds
- Students should learn purification techniques

Chapter 3: Chromatographic Techniques –Paper and Thin Layer Chromatography [10L]

Introduction - Introduction to chromatography, Types of chromatography.

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.

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.

Learning Outcomes:

Students should learn history and classification of chromatography

References:

1. Analytical Chemistry by G.D. Christian.
2. Calculation of Analytical Chemistry by Hamilton, Simpson &Ellis 7th Edn.

P.E.S. Modern College of Arts, Science and Commerce, Ganeshkhind, Pune - 16
(Autonomous)
Department of Chemistry 2023-24 Sem I
F.Y.B.Sc. Chemistry Minor SEC (Skill Enhancement Course) Syllabus

CHE11201 - Basic Practical Skills in Chemistry (2 Credits 30 Lecture/Practicals)

Course Outcomes:

CO 1: Students will understand the basic safety and the safety precautions to be taken during laboratory working.

CO 2: Students will understand the basic concepts of molarity, normality, etc. in Chemistry.

CO 3: Students will be able to prepare the solution of given concentration in given volume.

CO 4: Students will be able to measure the pH of various solutions using pH meter.

CO 5: Students will be able to purify the given organic compound by different techniques.

I] Laboratory Safety

1. Toxicity of the compounds used in chemical laboratory.
2. Safety symbols on labels of pack of chemicals and its meaning.
3. What is MSDS sheet? MSDS sheets for hazardous chemicals.
4. Precautions in handling of Hazardous substances.

II] Preparation of solutions

1. Concepts of Molarity, Molality, Normality, Percent solution, etc. in preparation of solution of given concentration.
2. To prepare solutions of Molar concentration.
(i) 0.15 M NaOH (ii) 0.1 M Oxalic acid
3. Preparation of Normal solutions.
(i) 0.02 N Oxalic acid (ii) 0.025 N KMnO₄
4. Preparation of Percent solution.
(i) 2 % KCl (ii) 3 % KI

III) Volumetric Analysis

1. Standardization of NaOH solution and to determine the strength of given HCl solution.

IV) Physical Chemistry Practicals

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos, soaps, etc. using pH meter.
2. Preparation of buffer solutions and measure the pH of acidic and basic buffer solutions using pH meter.
(i) Acidic buffer (Sodium acetate + Acetic acid)
(ii) Basic buffer (Ammonium chloride + Ammonium hydroxide)
3. To determine the heat of neutralization of HCl with NaOH.

V) Organic Chemistry Practicals

1. To purify the given organic compound by crystallization method, record the M.P. of the sample before and after the crystallization and find the yield of the purified compound.
2. To purify the given organic compound by sublimation method, record the M.P. of the sample before and after the crystallization and find the yield of the purified compound.

**P.E.S. Modern College of Arts, Science and Commerce, Ganeshkhind, Pune - 16
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**Department of Chemistry 2023-24 Sem II
F.Y.B.Sc. Chemistry Minor SEC (Skill Enhancement Course) Syllabus**

CHE12201 - Basic Analytical Techniques in Chemistry (2 Credits 30 Lecture/Practicals)

Course Outcomes:

CO 1: Students will understand different types of titrations and will be able to perform it.

CO 2: Students will be able to identify Inorganic and Organic compounds by systematic qualitative analysis.

CO 3: Students will be able to know different chromatographic techniques like paper and thin layer chromatography.

I] Analytical techniques: Volumetric analysis

1. To determine the exact concentration of KMnO_4 using oxalic acid.
2. To determine the hardness of water from a given sample of water by complexometric titration using EDTA.
3. To determine the amount of Na_2CO_3 and NaOH from a given mixture by titrating with standard HCl solution.
4. To determine the amount of Cu (II) from the given sample using iodometric titration.

II] Inorganic Qualitative analysis

1. To separate and identify acidic and basic radical from the given salt (2 salts).

III) Organic Qualitative analysis

1. To determine the type of the given organic compound (4 compounds).

IV) Chromatographic Analysis

1. To separate the components of a given mixture of amino acids by paper chromatography (2 mixtures).
 2. To separate the components of a given mixture of sugars by paper chromatography (2 mixtures).
 3. To separate the components in an organic mixture using Thin Layer Chromatography.
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OE1: Chemistry of Soaps, Detergents and Perfumes

CHE11301

(2 Credits, 30 Lectures.)

Course Outcomes:

CO 1: Skill development for detergent cake and liquid soap, shampoo, handwash making.

CO 2: Understanding of oil, fat, perfumes and their sources.

CO 3: The graduates will be able to apply knowledge of basic sciences of fragrance

CO 4: The graduates will be able to study the impact of Fragrance industry on the global, economic, and societal context.

Chapter -1: Introduction to oil and fats: (8 L)

- Introduction, Classification, structure and sources of oil and fats, basic terms involved.
- Natural sources of oils and fats

Learning Outcomes:

1. Students will understand basic concepts and techniques of soap and detergent industry.

Chapter -2: Soaps (8 L)

- Introduction to soaps, raw materials and its selection
- Principles of soap making and chemistry of soap, saponification process
- Hands on for soap making

Learning Outcomes:

1. Students will understand reactions of soaps.
2. Students will be able to prepare soaps.

Chapter -3: Detergents (6 L)

- Types of detergents, classification of detergents (anionic, cationic, non-ionic, amphoteric), biodegradability.
- Inorganic compounds of detergents (builder & other additives, phosphates, silicates, zeolites, etc.)
- Organic raw materials for manufacturing of fatty acids (olefins, alkyl benzene, methyl esters, fatty amines, ethylene oxide, propylene oxide sources and manufacture).

Learning Outcomes:

1. Skill development techniques for detergent cake and liquid soap, shampoo, hand wash making.

Chapter -3:Perfumes (8 L)

- Introduction, history of perfume, animal, synthetic, and structured perfume,
- Extraction of Aromatics, how to store aromatics
- Preparation of perfumes, attar etc.

References and Textbooks:

- Ajay Kr. Gupta, Handbook on Soaps, Detergents & Acid Slurry, 3rd revised edition; NIIR Board publication. ISBN: 9789381039472
- P. K. Chattopadhyay, Modern Technology of Soaps, Detergents & Toiletries (with Formulae & Project Profiles) 4th Revised Edition, NIIR Board publication; ISBN: 9789381039700
- H. Panda, Herbal Soaps & Detergents Handbook, NIIR Board publication; ISBN:9789381039007

SEMESTER-II

OE1: Food Adulteration CHE12301

(2 Credits, 30 Lectures.)

Course Outcomes:

CO 1: Become aware of the food quality determinants and their estimation methods

CO 2: To understand the basic principles of food preservation

CO 3: To get familiarized with food adulteration and prevention acts

Chapter 1: Introduction

[08L]

Introduction: Basic food groups, Food adulteration and contamination, common food contaminants & adulterants. Food Quality & Safety, various aspects of food quality & safety

Learning Outcomes:

1. To understand the definition, concepts and functions of food and nutrition.
2. To make them aware of various quality criteria

Chapter 2: Food Adulteration

[12 L]

Nature of adulterants, methods of evaluation of food adulterants and

toxic constituents in foods, common food adulterants & their detection on various foods like

a) Milk and Milk products

b) Oils and fats

c) Spice and condiments

d) Wheat and other flours

e) Sugar and Preserve

f) Fruit and Vegetable products

g) Beverages Alcoholic and Non-Alcoholic

Learning Outcomes:

1. To understand various changes occurring in food components during processing
2. To gain knowledge regarding modern methods of food analysis

Chapter 3: Food Laws and Regulation

[10]

Prevention of Food Adulteration Act 1954, Food Safety and Standards Act (2006), Food Safety and Standards Authority of India (FSSAI), BIS, FPO, APEDA

Learning Outcomes:

1. To get familiarized with food adulteration and prevention acts
2. To understand the basic principles of food preservation

Recommended Books:

1. Gould, W.A and Gould, R.W. (1998). Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
2. Furia, T.E. Ed. 1980. Regulatory Status of Direct Food Additives. CRC Press, Florida.
3. Rekha S. Singhal , Pushpa R. Kulkarni, Dananesh V. Rege, (1997). Hand Book of Indices of food Quality and Authenticity, wood head Publishing Ltd.
4. Siva Kiran, R.R. (2012). Manual for Detection of Common Food Adulterants, First Edition, IAPEN.
5. Battershal, J.P. (2013). Food Adulteration & its detection, General Books LLC.
6. Prevention of Food Adulteration Act, 4th Edition, Ashoka Law House, 2002.
7. Srilakshmi. B. Food Science. New - Age International (P) Ltd. Publishers, New Delhi, 1997.
8. Swaminathan M. Food Science Chemistry and Experimental foods, The Bangalore Printing and Publishing Co. Ltd., Mysore, Bangalore 1990.
9. Potter, N.N. Food Science, 3rd Ed CBS Publishers and Distributors. Delhi, 1987