



KADI SARVA VISHWAVIDYALAYA

**KADI SARVA
VISHWAVIDYALAYA,
GANDHINAGAR**



**B.Sc. Curriculum as Per NEP
Chemistry Course for Semester 1**

W.E.F. June 2023



Chemistry Major Course -1

CHM203-1C - FUNDAMENTALS OF CHEMISTRY-I

LEARNING OUTCOMES:

- In this course, student will delve into the concept of the origin of chemistry, including the formation of molecules
- Student will acquire knowledge regarding the structure, function, and practical applications of various chemicals
- They will develop a comprehensive understanding of the chemical properties of compounds, as well as gain insights into the behaviour of chemical ions.

Subject Code	Subject Title	Teaching Scheme		Credits	Examination Scheme			Total Marks
		Theory hrs Per Week	Practical hrs Per Week		Hrs.	Max Marks		
						Mid Term	End Term	
CHM203-1C	Fundamentals of Chemistry-I	4	0	4	2.5	50	50	100

Contents

Unit 1: Chemical Bonding

Teaching Hours: 15 (Weightage 25%)

- Valence bond theory, its application and limitation of VBT • Directional characteristics of covalent bond • Types of hybridization and shape of simple inorganic molecules (BeCl_2 , BCl_3 , CH_4 , PCl_5 , SF_6) • V.S.E.P.R. theory for NH_3 , H_2O , BF_3 • M.O. Theory-Energy level diagram for homo nucleus diatomic molecules (N_2 and O_2) and hetero diatomic molecule (CO , HF , HCl and NO), Bond strength, Bond energy, Fajan's rule, polarization power, Dipole moment, Electronegativity.
- s and p-block elements- Periodicity, properties, diagonal relationship, salient features of hydrides, oxides, hydroxides, carbonates, sulphates



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Unit 2: Structure Properties and Reaction Mechanism

Teaching Hours: 15 (Weightage 25%)

- Intramolecular forces (Hydrogen bonding, dipole-dipole interaction, Van der Waals forces) • Electromeric effect • Inductive effect • Resonance effect (draw resonating structures of Nitro benzene, Chlorobenzene, Phenoxide ion, Anilinium ion, Acetate ion) • Hyper conjugation (o,p-directing group and their effect, Stability of Carbonium ion, Carbanions and Free radicals)
- Types of reaction intermediates, Fission of Co-Valent bond (With at least one example of each intermediates) • Types of reagents. • Types of organic reaction with

mechanism. • Substitution reactions (Nucleophilic & Electrophilic) • Addition reactions (Nucleophilic & Electrophilic) • Elimination reactions (E1 & E2), Basics of Aromaticity

Unit 3: Physical and Analytical Chemistry

Teaching Hours: 15 (Weightage 25%)

- Atomic structure- Dual nature of electron, De Broglie equation, Davisson and Germer experiment, Heisenberg uncertainty principle, Schrodinger wave equation (only definition, no derivation), significance of ψ and ψ^2 , probability distribution curve, shapes of s, p and orbitals, Zeeman and Stark effects
- Introduction to Analytical Chemistry • Classification of Classical and Electro Analytical Techniques. • Literature of Analytical Chemistry (Names of Author and Publishers for Any Ten Books, Journals and Reviews) • Criterion for Selection of analytical Techniques. • Analytical Data Treatment Error, Types of errors, Accuracy and Precision. Statistical Terms: Mode, Average, Median, Deviation, Average Deviation, Relative Average Deviation, Standard Deviation & Coefficient of variance. Q-Test for the rejection of result and related numerical, Grubb's Test

Unit 4: Thermodynamics

Teaching Hours: 15 (Weightage 25%)

- Thermodynamics (only introduction) • System and surrounding- work & heat, state function, thermodynamic process, internal energy, enthalpy, free energy, maximum work function. • First law of thermodynamics • Heat capacity, specific and molar heat capacity, heat capacity at constant volume and pressure and their relationship • Work done in adiabatic and isothermal reversible expansion of an ideal gas. • Second law of thermodynamics • Carnot cycle and its efficiency • Concept of entropy; entropy change for an ideal gas under different conditions, entropy change for mixture of ideal gases • Gibbs-Helmholtz equation, Van Hoff Isochore and Isotherm, Numerical.



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Reference books:

1. 'Concise Inorganic Chemistry' J.D.Lee, 5th edn.
2. Text book of Organic Chemistry, Arun Bahal, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Analytical Chemistry, Garry D.Christain.



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Chemistry Major Course -2

CHM204-1C -CHEMISTRY PRACTICALS-I

LEARNING OUTCOMES:

- Throughout this course, students will cultivate an understanding of chemical systems and thermodynamics
- They will acquire knowledge regarding the structural orientation of molecules in space and their respective functions
- Furthermore, students will develop a comprehensive understanding of the behavior of solutions in terms of acid-base interactions.

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Practical hrs Per Week		Hrs.	Max Marks		
					Mid Term	End Term	
CHM204-1C	Chemistry Practicals-I	8	4	5	50	50	100

Unit 1: Chemistry Practicals

(Weightage 50%)

1. Introductory Knowledge of Laboratory Glassware
2. Volumetric titration (**MINIMUM 8**)
 - To determine the strength of NaOH and Na₂CO₃ present in the solution mixture of NaOH & Na₂CO₃ and to find out their percentage composition.
 - To determine the strength of NaHCO₃ and Na₂CO₃ present in the solution mixture of NaHCO₃ & Na₂CO₃ and to find out their percentage composition.
 - To determine the Normality, gram/liter and molarities of H₂C₂O₄, 2H₂O and H₂SO₄ present in the solution mixture of H₂C₂O₄, 2H₂O & H₂SO₄ by using X N NaOH and Y N KMnO₄ solutions.
 - To determine the Normality, gram/liter and molarity of H₂C₂O₄, 2H₂O and K₂C₂O₄ present in the solution mixture of H₂C₂O₄, 2H₂O & K₂C₂O₄ by using NaOH and KMnO₄ solutions.
 - To determine the amount of Ca⁺² and Mg⁺² ion by EDTA solution from the mixture solution of CaCl₂ and MgCl₂.
 - To estimate the strength of given Mohr's salt by titrating it against KMnO₄
 - To estimate the strength of CuSO₄ solution iodometrically by titrating it against Na₂S₂O₃ solution.
 - Estimation of Fe²⁺ by titrating it with K₂Cr₂O₇ using Diphenylamine as an internal indicator.
 - Estimation of number of water of crystallization in Mohr's salt by titrating with KMnO₄.



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3. Melting point and Boiling point (Any two organic compounds)
4. Calibration of burette, Pipette and measuring flask

Unit 2: Inorganic Salts

(Weightage 50%)

Semi micro Analysis: - (Minimum TEN)

- Cation analysis; separation and identification of ions from group I, II, III-A, III-B, IV, V-A, V-B.
- Anion analysis like Cl^- , Br^- , I^- , NO_3^- , NO_2^- , SO_4^{2-} , SO_3^{2-} , S^{2-} , CO_3^{2-} , CrO_4^{2-} (Water Soluble and insoluble).

Reference books:

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by GH Jeffery and others) 5th Ed. The English Language Book Society of Longman
2. Willard, Hobert H. et. al: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, Gary D; Analytical Chemistry, 6th Ed. New York- John Willy, 2004.
4. Harris, Daniel C, Quantitative Chemical Analysis, 3 rd Edition, W.H. Freeman and Company, New York, 2001.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry New Age, International Publisher, 2009.
6. Koogs, West and Holler, Fundamentals of Analytical Chemistry, 6 th Edition, Saunders College Publishing, New York. 1991.



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Chemistry Minor Course- Semester 1

CHE202-1C - BASICS OF CHEMISTRY-I

LEARNING OUTCOMES:

- In this course, student will delve into the concept of the origin of chemistry, including the formation of molecules with different hybridization.
- Student will acquire knowledge regarding the structure, function, and practical applications of various chemicals
- They will develop a comprehensive understanding of the chemical properties of compounds, as well as gain insights into the behaviour of chemical ions

Subject Code	Subject Title	Teaching Scheme		Credits	Examination Scheme			Total Marks
		Theory hrs Per Week	Practical hrs Per Week		Hrs.	Max Marks		
						Mid Term	End Term	
CHE202-1C	Basics of Chemistry-I	2	4	4	2.5	50	50	100

Unit 1: Chemical Bonding

Teaching Hours: 15

- Valence bond theory, its application and limitation of VBT • Directional characteristics of covalent bond • Types of hybridization and shape of simple inorganic molecules (BeCl_2 , BCl_3 , CH_4 , PCl_5 , SF_6) • V.S.E.P.R. theory for NH_3 , H_2O , BF_3 • M.O. Theory-Energy level diagram for homo nucleus diatomic molecules (N_2 and O_2) and hetero diatomic molecule (CO , HF , HCl and NO), Bond strength, Bond energy, Fajan's rule, polarization power, Dipole moment, Electronegativity.
- s and p-block elements- Periodicity, properties, diagonal relationship, salient features of hydrides, oxides, hydroxides, carbonates, sulphates

Unit 2: Structure Properties and Reaction Mechanism

Teaching Hours: 15

- Intramolecular forces (Hydrogen bonding, dipole-dipole interaction, Van der Waals forces) • Electromeric effect • Inductive effect • Resonance effect (draw resonating structures of Nitro benzene, Chlorobenzene, Phenoxide ion, Anilinium ion, Acetate ion) • Hyper conjugation (o,p-directing group and their effect, Stability of Carbonium ion, Carbanions and Free radicals)
- Types of reaction intermediates, Fission of Co-Valent bond (With at least one example of each intermediates) • Types of reagents. • Types of organic reaction with mechanism. • Substitution reactions (Nucleophilic & Electrophilic) • Addition



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reactions (Nucleophilic & Electrophilic) • Elimination reactions (E1 & E2), Basics of Aromaticity

Unit 3: Chemistry Practical's

Teaching Hours: 30

1. Introductory Knowledge of Laboratory Glassware
2. Volumetric titration (**MINIMUM 8**)
 - To determine the strength of NaOH and Na₂CO₃ present in the solution mixture of NaOH & Na₂CO₃ and to find out their percentage composition.
 - To determine the strength of NaHCO₃ and Na₂CO₃ present in the solution mixture of NaHCO₃ & Na₂CO₃ and to find out their percentage composition.
 - To determine the Normality, gram/liter and molarities of H₂C₂O₄, 2H₂O and H₂SO₄ present in the solution mixture of H₂C₂O₄, 2H₂O & H₂SO₄ by using X N NaOH and Y N KMnO₄ solutions.
 - To determine the Normality, gram/liter and molarity of H₂C₂O₄, 2H₂O and K₂C₂O₄ present in the solution mixture of H₂C₂O₄, 2H₂O & K₂C₂O₄ by using NaOH and KMnO₄ solutions.
 - To determine the amount of Ca⁺² and Mg⁺² ion by EDTA solution from the mixture solution of CaCl₂ and MgCl₂.
 - To estimate the strength of given Mohr's salt by titrating it against KMnO₄
 - To estimate the strength of CuSO₄ solution iodometrically by titrating it against Na₂S₂O₃ solution.
 - Estimation of Fe²⁺ by titrating it with K₂Cr₂O₇ using Diphenylamine as an internal indicator.
 - Estimation of number of water of crystallization in Mohr's salt by titrating with KMnO₄
3. Melting point and Boiling point (Any two organic compounds)
4. Calibration of burette, Pipette and measuring flask

Reference books:

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2. Text book of Organic Chemistry, Arun Bahal, S.Chand.
3. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by GH Jeffery and others) 5th Ed. The English Language Book Society of Longman
4. Willard, Hobert H. et. al: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
5. Christian, Gary D; Analytical Chemistry, 6th Ed. New York- John Willy, 2004.
6. Harris, Daniel C, Quantitative Chemical Analysis, 3 rd Edition, W.H. Freeman and Company, New York, 2001.
7. Khopkar, S.M. Basic Concepts of Analytical Chemistry New Age, International Publisher, 2009.
8. Koogs, West and Holler, Fundamentals of Analytical Chemistry, 6 th Edition, Saunders College Publishing, New York. 1991.



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Chemistry Multidisciplinary Course – Semester 1

MDC213-1C - INTRODUCTION TO CHEMISTRY-I

LEARNING OUTCOMES:

- Students will gain Knowledge of basic principles of chemistry, types of solutions, acidbase concept, periodic table and important chemical properties
- Through this the students will understand importance of different compounds based on various chemical parameters like thermodynamics and kinetics
- Students will get a chance to learn the naming of simple organic compounds.

Subject Code	Subject Title	Teaching Scheme		Credits	Examination Scheme			Total Marks
		Theory hrs Per Week	Practical hrs Per Week		Hrs.	Max Marks		
						Mid Term	End Term	
MDC213-1C	Introduction to Chemistry-I	2	4	4	2.5	50	50	100

Unit 1: Solution and Concentration

Teaching Hours: 15

Mole concept, Mole fraction, Concentration terms - percentage, ppm, ppb, g/L, molarity, normality, molality, calculation of masses and volumes for preparation of solutions and their practical approach, Solutions, components of a solution, types of solution, solubility, Buffer solutions, saturated solutions, Concentrate and dilute solutions

Unit 2. Chemical Properties and Principles

Teaching Hours: 15

Periodic table and periodicity, Acid base theories, Interaction forces, IUPAC nomenclature of Organic main functional groups, Definition of thermodynamics, kinetics and equilibrium. Stoichiometry.
Density, Viscosity, Surface tension, Ostwald dilution law, Ionic Strength, Conductivity, pH, common ion effect, solubility product, residue, precipitation, Crystallization.



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Unit 3: Chemistry Practicals (Each 2 times)

Teaching Hours: 30

- Preparation of Molar, Molal, % w/w, %w/v, ppm solution
- Find out the surface tension and viscosity of given sample
- To recrystallize the given organic compound using water/ alcohol as a solvent
- Find out the melting/ Boiling point of given sample
- Find out the concentration of given unknown solution using simple titration.
- Find out the acidity and basicity of given sample solution

Reference books:

1. 'Concise Inorganic Chemistry' J.D.Lee, 5th edn.
2. Text book of Organic Chemistry, Arun Bahal, S.Chand.
3. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by GH Jeffery and others) 5th Ed. The English Language Book Society of Longman



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Chemistry SEC (Skill Enhancement Course)– Semester1

SEC212-1C - CHEMISTRY INSTRUMENTATION AND LABORATORY SKILLS-I

LEARNING OUTCOMES:

□ The objective of this course is to foster proficiency in fundamental knowledge of chemistry laboratories, laboratory equipment, preparation of solutions □ Application of physicochemical principles in laboratory experiments.

Subject Code	Subject Title	Teaching Scheme		Credits	Examination Scheme			Total Marks
		Theory hrs Per Week	Practical hrs Per Week		Hrs.	Max Marks		
						Mid Term	End Term	
SEC212-1C	Chemistry Instrumentation and laboratory skills-I	2	0	2	2	25	25	50

Details

Unit 1. Laboratory apparatus & their uses (Weightage :50%)

Beaker, test tube, boiling tube, conical flask/ Erlenmeyer flask, filtration flask, round bottom flask, flat bottom flask, funnel, separating funnel, watch glass, measuring cylinder, petridish, desiccator, measuring cylinder, glass rod, glass tube. Volumetric flask, burette, pipette, analytical balance, electronic balance. Heating apparatus: Bunsen burner, water bath, sand bath, hot air oven, heating mantle. Buchner funnel, burner, test tube stands, tong, burette stand, clamp, china dish, wire gauze, cork, vacuum pumps, crucibles, clay pipe triangle, pestle and mortar, spatulas, thermometer, pH meter, Kipp's apparatus, Safe Handling of Chemicals and Glass wares

Unit 2: Solvent and Reagents (Weightage :50%)

Reagents: Classification of reagents according to their action; (i) acids (ii) bases (iii) salts (iv) complexing agents (v) oxidizing and reducing agents (vi) precipitating agents (vii) chelating agents. Each type to be explained with at least one suitable example. Primary and secondary standards: Definition, characteristics, uses examples for different types of reactions. Solvent: Solute, Solvent & Solution, classification of solvents (i) Protic and aprotic (ii) Acidic, basic amphiprotic and neutral (iii) Aqueous and non-aqueous (iv) Polar and nonpolar. Each type is to be explained with at least one example.



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