SNDT Women's University, Mumbai

Bachelor of Science (Chemistry)

B.Sc. (Chemistry)

As Per NEP - 2020

Syllabus

(2024-2025)

Credit structure For Under Graduate Programmes in Humanities, Science and Technology and Interdisciplinary Studies Faculties
(2024 May as per GR dated 13/03/2024)

	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total
Subject No 1 (to be treated as Major)	4		12	12	8	10	**46**
Subject No 2 (A and B), so minor	2	2	2		4	4	**14**
Subject No 3		4					**4**
VSC S1	2				2		**4**
VSC S2		2					**2**
VSC S3		2					**2**
Major (Elective)					4	4	**8**
OEC	4	4	2	2			**12**
SEC	2	2		2			**6**
AEC (English)	2	2	2	2			**8**
AEC (Modern Indian Language)			2	2			**4**
VEC	2	2					**4**
CC	2	2	2	2			**8**
IKS (Generic)	2						**2**
IKS (Major-Specific)					2		**2**
FP					2		**2**
OJT						4	**4**
	22	**22**	**22**	**22**	**22**	**22**	**132**

Terminologies

Abbreviation	Full-form	Remarks	Related to Major and Minor Courses
Major (Core)	Main Discipline		
Major (Elective)	Elective Options		related to the Major Discipline
Minor Stream	Other Disciplines (Inter/ Multidisciplinary) not related to the Major	either from the same Faculty or any other faculty	
OEC	Open Elective Courses/ Generic		Not Related to the Major and Minor
VSC	Vocational Skill Courses		Related to the Major and Minor
SEC	Skill Enhancement Courses		Not Related to the Major and Minor
AEC	Ability Enhancement Courses	Communication skills, critical reading, academic writing, etc.	Not Related to the Major and Minor
VEC	Value Education Courses	Understanding India, Environmental science/education, Digital and technological solutions, Health & Wellness, Yoga education, sports, and fitness	Not Related to the Major and Minor
IKS	Indian Knowledge System	I. Generic IKS Course: basic knowledge of the IKS II. II. Subject-Specific IKS Courses: advanced information about the subject: part of the major credit	Subject Specific IKS related to Major
OJT	On-Job Training (Internship/Apprenticeship)	corresponding to the Major Subject	Related to the Major
FP	Field projects	corresponding to the Major Subject	Related to the Major
CC	Co-curricular Courses	Health and Wellness, Yoga education sports, and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts	Not Related to the Major and Minor
CE	Community Engagement and service		Not Related to the Major and Minor
RP	Research Project	corresponding to the Major Subject	Related to the Major

Programme Template

Degree		B.Sc.
Program		Chemistry
Preamble (Brief Introduction to the program)		The undergraduate program in Chemistry, aligned with NEP 2020 guidelines, offers a robust foundation in chemical sciences, blending core subjects, electives, and hands-on laboratory experiences. This program prepares students for careers in academia, industry, research, environmental science, pharmaceuticals, and entrepreneurship. Graduates will be equipped with critical thinking, problem-solving skills, and a deep understanding of chemical principles, ready to contribute to sustainable development and innovation. The program emphasizes a comprehensive understanding of various chemistry disciplines, practical application of knowledge, and the development of advanced laboratory techniques. After completing this program, students will develop expertise in instrumentation and laboratory techniques, enabling them to conduct independent experiments and interpret data accurately. They will demonstrate strong theoretical and practical knowledge, applying it effectively in professional settings. Students will enhance their analytical and problem-solving skills, understanding the societal and environmental impact of chemical solutions and advocating for sustainable practices. Additionally, they will engage in lifelong learning, integrate interdisciplinary knowledge, and demonstrate effective communication and teamwork skills, preparing them for a dynamic and evolving job market.
Programme Specific Outcomes (PSOs)		After completing this program, the learner will be able to,
	1.	Apply principles of chemistry and creative thinking to solve diverse problems in chemistry
	2.	Critically analyze chemical data, evaluate scientific literature, and construct coherent scientific arguments.
	3.	Design experiments and use appropriate methodologies for data collection and analysis.
	4.	Effectively communicate chemical concepts and research findings clearly in writing and orally.
	5.	Work effectively in diverse teams and exhibit leadership skills in guiding projects and research initiatives.
	6.	Utilize ICT tools for data analysis and research.
	7.	Apply ethical principles, promote sustainability, and engage in community outreach to advance public understanding of chemistry
Eligibility Criteria for Programme		12^{th} standard Science
Intake		120

Structure with Course Titles

B. Sc. Chemistry

SN	Courses	Type of Course	Credits	Marks	Int	Ext
	Semester I					
10032101	Surface Chemistry	Major (Core)	2	50	50	0
		Major (Core)	2	50	0	50
		Major (Core)	2	50	50	0
10432111	Dyes and Pigment	OEC	4	100	50	50
10632101	Practical of Chemistry	VSC	2	50	50	0
10732101	Leadership development program	SEC	2	50	50	0
	English - I	AEC (English)	2	50	0	50
	Inception of Indian Knowledge System	IKS (Generic)	2	50	0	50
		VEC	2	50	0	50
	Co-curricular activity	CC	2	50	50	0
			22	**550**	**300**	**250**
	Semester II					
20032111	Aromatic Chemistry	Major (Core)	2	50	0	50
		Major (Core)	2	50	50	0
		Major (Core)	2	50	0	50
		VSC S2	2	50	0	50
		VSC S3	2	50	0	50
20432111	Science Cafe	OEC	4	100	50	50
20732101	Personality And Communication	SEC	2	50	50	0
	English -II	AEC (English)	2	50	50	0
		VEC	2	50	0	50
	Co-curricular activity	CC	2	50	50	0
			22	**550**	**250**	**300**

Exit with UG Certificate with 4 extra credits (44 + 4 credits)

Course Syllabus

Semester I

1.1 Major (Core)

Course Title	Surface Chemistry
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Apply adsorption principles using Freundlich and Langmuir isotherms in industrial processes
	2. Analyze physisorption and chemisorption characteristics and factors affecting gas adsorption on solids.
	3. Evaluate the effectiveness and selectivity of homogeneous, heterogeneous, and enzymatic catalysts
	4. Design experiments to investigate colloid properties and phenomena like Tyndall effect and Brownian movement
Module 1 (Credit 1) - Adsorption & Catalysis	
Learning Outcomes	After learning the module, learners will be able to,
	1. Utilize the Freundlich and Langmuir isotherms to address adsorption issues involving gases on solids.
	2. Assess the effectiveness and selectivity of homogeneous and heterogeneous catalysts, including enzymatic mechanisms.
Content Outline	● Adsorption- Physisorption and chemisorption and their characteristics, factors affecting adsorption of gasses on solids - Freundlich and Langmuir adsorption isotherms, adsorption from solutions. ● Catalysis - Homogeneous and heterogeneous, activity and selectivity of solid catalysts, enzymecatalysis and its mechanism. ● Colloidal state- distinction among true solutions, colloids and suspensions, classification of colloids -lyophilic. Lyophobic; multimolecular, macromolecular and associated colloids (micelles). preparation and properties of colloids - ● Tyndall effect. Brownian movement, electrophoresis, dialysis, coagulation and flocculation: Emulsions and their characteristics.
Module 2 (Credit 1) - Reaction Dynamics	
	After learning the module, learners will be able to,
	1. Implement the concepts of inductive, electromeric, resonance, and mesomeric effects in analyzing organic reactions.

	2. Examine the types, shapes, and relative stability of electrophiles, nucleophiles, and reaction intermediates like carbocations and free radicals.
Content Outline	• Electronic Displacements: Inductive, electromeric, resonance and mnesomeric effects,hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relativestrength. Homolytic and heterolytic fission with suitable examples. Curly arrow rules; • Electrophiles and Nucleophiles; Nucleophilicity and basicity; Types, shape and relative stability of carbocations, carbanions, free radicals and carbenes. Introduction to types of organicreactions and their mechanism: Addition, Elimination and Substitution reactions. • Carbon-carbonsigma bonds Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1 - Adsorption & Catalysis

Project 1: Household Adsorbent Investigation

Description: Students will explore adsorption principles using household materials like activated charcoal, tea bags, and various colored solutions such as food coloring or ink. By placing the household adsorbents in containers with colored solutions, they will observe and document the changes in color over time. Through simple filtration techniques, students will separate the adsorbents from the solutions and analyze the remaining color concentration. This project not only demonstrates adsorption concepts but also connects classroom learning to real-world scenarios, such as water purification or air filtration systems, that are applicable in both urban and rural environments.

Safety Measures: Ensure students handle materials safely, avoid ingestion of any chemicals, and conduct experiments in well-ventilated areas to prevent exposure to harmful fumes.

Project 2: Kitchen Catalyst Investigation

Description: Students will explore catalysis principles using common kitchen ingredients like potatoes, yeast, and hydrogen peroxide. By mixing hydrogen peroxide with grated potatoes and yeast solutions in separate containers, students will observe the production of foam over time. They will measure and compare the quantity of foam produced by each catalyst to evaluate their effectiveness in catalyzing the decomposition of hydrogen peroxide. This project provides a hands-on experience that bridges classroom learning with real-world applications, such as understanding the role of catalysts in food processing or environmental remediation, and can be easily conducted in home kitchens or school labs.

Safety Measures: Students should handle hydrogen peroxide with care, wear protective gloves and goggles, and conduct experiments in a controlled environment to prevent spills and accidents.

Module 2 (Credit 1) - Reaction Dynamics

Project 1: Kitchen Chemistry: Organic Reactions

Description: Students will explore organic reaction mechanisms using readily available kitchen ingredients such as vinegar, baking soda, and lemon juice. By conducting simple experiments like

vinegar-baking soda reaction or lemon juice with milk, students will observe the formation of reaction products and propose mechanisms based on their understanding of inductive and resonance effects. This project fosters a connection between classroom learning and real-world scenarios, such as understanding the chemistry behind food preservation or cooking processes, and can be easily conducted in home kitchens or school labs.

Safety Measures: Students should handle chemicals with care, avoid ingestion, and conduct experiments in a well-ventilated area to prevent exposure to fumes.

Project 2: Home Chemistry: Alkane Reactivity

Description: Students will investigate alkane reactivity using common household solvents like rubbing alcohol and various cleaning agents containing chlorine. By mixing alkanes with these solvents in separate containers, students will observe the formation of reaction products and assess the relative reactivity and selectivity of different halogens. This project allows students to connect classroom learning with real-world applications, such as understanding the chemistry behind cleaning products or disinfectants used in everyday life, and can be easily conducted in home environments or school labs.

Safety Measures: Students should handle chemicals with care, avoid ingestion, and conduct experiments in a well-ventilated area to prevent exposure to fumes.

Reference Books:

1. Cotton, F. A., Wilkinson, G., & Gaus, P. L. (1987). Basic Inorganic Chemistry (5th ed.). John Wiley.
2. Rao, C. N. R. (2000). University General Chemistry. Macmillan, India.
3. Chanda, M. (2000). Atomic Structure and Chemical Bond (4th ed.). Tata McGraw-Hill.

1.4 Open Elective Course (OEC)

Course Title	Dyes and Pigment
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Apply fundamental dye concepts practically in textiles.
	2. Analyze diverse dye, pigment, and auxiliaries' applications.
	3. Evaluate production methods and properties of dyes.
	4. Design innovative solutions for textile industry challenges.
Module 1 (Credit 1) - Dye Fundamentals	
Learning Outcomes	After learning the module, learners will be able to,
	1. Investigate fundamentals of dyes, including chemical chromophores.
	2. Assess dye classes and their principal applications, including synthesis of commercial dyes.
Content Outline	● Fundamental of dyes: General, Important chemical chromophore of dyes ● Dyes Class for principle applications, Description of individuals of class and synthesis of some commercial dyes.
Module 2 (Credit 1) - Textile Dyeing Techniques	
Learning Outcomes	After learning the module, learners will be able to,
	1. Explore dying processes of textiles, including pre-treatment of fibers and dyeing methods for various textiles, as well as textile finishes and auxiliaries.
	2. Examine non-textile dyes, such as those used in leather, fur, hair, food, ink, photography, and as indicator dyes.
Content Outline	● Dying processes of textiles: Pre-treatment of textile fibers, dyeing methods for various textiles,Textile finishes and Textile auxiliaries. ● Non textile dyes: Leather, Fur, Hair, Food, Ink, Photographic, indicator dyes.
Module 3 (Credit 1) - Zinc Oxide Pigments	
Learning Outcomes	After learning the module, learners will be able to,
	1. Develop a study on fundamentals, properties, and production of Iron Oxide pigments, specifically focusing on the precipitation process.
	2. Examine fundamentals, properties, and production methods of Zinc Oxide pigments, including raw materials and processes such as the Direct (American) and Precipitation processes.
Content Outline	● Zinc Oxide pigments (Fundamentals and properties, Raw materials, Direct process (American process), Precipitation process) ● Iron oxide pigments (Fundamentals and properties, Production of iron oxide pigment by precipitation process)

Module 4 (Credit 1) - Advanced Dye Applications	
Learning Outcomes	After learning the module, learners will be able to,
	1. Design experiments for synthesis, characterization, and application of dyes.
	2. Explore additional aspects of dyes, such as non-mutagenic variants and colorants for high-tech fluorescent brightening agents.
Content Outline	• Synthesis, Characterization and application. • Some other aspects related to dyes: Non mutagenic dyes, colorants for high technology Fluorescent Brightening agents.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1 - Dye Fundamentals

Project 1: Chromophore Exploration

Description: Students will investigate the fundamentals of dyes by analyzing the chemical chromophores responsible for coloration. They will select common household items such as food coloring, ink cartridges, or fabric dyes and perform simple separation techniques like paper chromatography to isolate and identify the chromophores present. Through observation and analysis, students will deepen their understanding of dye chemistry and its practical applications, particularly in textile dyeing processes.

Safety Measures: Ensure students handle chemicals safely and conduct experiments in a well - ventilated area.

Module 2 - Textile Dyeing Techniques

Project 1: Fabric Dyeing Experiment

Description: Students will explore textile dyeing techniques by designing and conducting experiments to dye fabric samples using natural or synthetic dyes. They will pre-treat fabric fibers to enhance dye uptake and select appropriate dyeing methods such as immersion, padding, or printing techniques. Through hands-on experimentation, students will observe and analyze the effects of different dyeing parameters on color intensity, fastness properties, and overall textile appearance. This project provides practical experience in textile dyeing processes and allows students to apply their knowledge to address challenges in the textile industry.

Safety Measures: Ensure students handle dyes and chemicals safely, follow proper dyeing protocols, and dispose of waste materials appropriately.

Module 3 - Zinc Oxide Pigments

Project 1: Zinc Oxide Pigment Production Simulation

Description: Students will simulate the production process of zinc oxide pigments, focusing on the precipitation method. They will research the raw materials and equipment used in the Direct (American) and Precipitation processes and develop a step-by-step simulation. Using available resources, students will set up experimental setups mimicking the precipitation reaction, observing the formation and properties of zinc oxide pigments. Through this hands-on simulation, students will gain a deeper understanding of the fundamentals and production methods of zinc oxide pigments, preparing them for real-world applications in the pigment industry.

Safety Measures: Ensure students handle chemicals safely and conduct experiments in a well - ventilated area.

Module 4 - Advanced Dye Applications

Project 1: Dye Synthesis and Application Design

Description: Students will design and execute a series of experiments to synthesize novel dyes and evaluate their application potential. They will explore various synthetic routes to prepare new dye compounds and characterize their chemical structures using spectroscopic techniques. Students will then test the synthesized dyes on different substrates such as fabrics, plastics, or paper to assess their coloration efficiency and fastness properties. Through this project, students will gain hands-on experience in dye synthesis, characterization, and application, fostering innovation and problem - solving skills in dye chemistry.

Safety Measures: Ensure students handle chemicals safely and wear appropriate personal protective equipment.

Reference Books:

1. Sharma, B. K. (2014). Industrial Chemistry (18th ed.). Goel Publishing House.
2. Kent, J. A. (Ed.). (Year of Publication). Riegel's Handbook of Industrial Chemistry (9th ed.). CBS Publishers.
3. Satyaprakash, Tuli, & Basu. (Year of Publication). Advanced Inorganic Chemistry (pp. 458 - 463).
4. Satyaprakash, Tuli, & Basu. (Year of Publication). Advanced Inorganic Chemistry (pp. 830 - 849).
5. Kent, J. A., Bommaraju, T. V., & Barnicki, S. D. (Year of Publication). Handbook of Industrial Chemistry and Biotechnology (13th ed.). Springer.

1.5 Vocational Skill Courses (VSC)

Course Title	Practical of chemistry (Lab)
Course Credits	2
Course Outcomes	After going through the course, learners will be able to,
	1. Apply titration and hydrolysis techniques to determine the concentrations of iodine, phenol, aniline, acetamide, and ethyl benzoate using standard methods.
	2. Analyze complexometric and Mohr's titrations to quantify sodium carbonate, sodium bicarbonate, carbonate, hydroxide, and magnesium in mixtures.
	3. Evaluate the precision and effectiveness of analytical methods like bromination and hydrolysis for determining chemical compositions.
	4. Design experiments to measure concentrations of ferrous and ferric ions, Mohr's salt, and oxalic acid using internal indicator methods and standardized solutions.
Module 1 (Credit 1) - Quantitative Chemical Analysis	
Learning Outcomes	After learning the module, learners will be able to,
	1. Utilize titration techniques to determine the concentration of iodine using standardized sodium thiosulphate and potassium dichromate solutions.
	2. Examine bromination methods to quantify phenol and aniline accurately.
	3. Assess hydrolysis methods for determining the concentrations of acetamide and ethyl benzoate.
	4. Develop and conduct experiments to accurately measure the concentration of various compounds using standard analytical techniques.
Content Outline	• Determination of iodine using sodium thiosulphate (Standardize sodium thiosulphate solution) using standard potassium dichromate solution. • Determination of phenol by bromination method. • Determination of aniline by bromination method. • Determination of acetamide by hydrolysis method. • Determination of ethyl benzoate by hydrolysis method.
Module 2 (Credit 1) - Analytical Methods for Salt Mixtures	
Learning	After learning the module, learners will be able to,

Outcomes	1. Utilize titration techniques to determine the concentrations of sodium carbonate and sodium bicarbonate in a mixture. 2. Examine the presence and quantification of carbonate and hydroxide together in a mixture. 3. Assess the concentrations of Mohr's salt and oxalic acid separately using standardized $KMnO_4$ solution. 4. Determine the concentrations of ferrous and ferric ions in a solution using the internal indicator method with a standard $K_2Cr_2O_7$ solution. 5. Develop accurate measurements of magnesium using standardized EDTA and zinc sulfate solutions.
Content Outline	• Determination of sodium carbonate and sodium bicarbonate in a mixture. • Determination of carbonate and hydroxide present together in a mixture. • Determination of Mohr's salt and oxalic acid separately using standardized $KMnO_4$ solution. • Determination of ferrous and ferric ions in a solution using standard solution of $K_2Cr_2O_7$ byinternal indicator method (diphenylamine or N-phenylanthranilic acid). • Determination of magnesium using standard EDTA solution (Standardize EDTA solution using standard zinc sulfate solution).

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. **Project 1: Iodine Determination**

Design an experiment to determine the concentration of iodine in a sample using titration with standardized sodium thiosulphate and potassium dichromate solutions. Prepare a detailed report analyzing the procedure, results, and potential sources of error.

2. **Project 2: Phenol and Aniline Quantification**

Conduct bromination reactions to accurately quantify the concentrations of phenol and aniline in given samples. Document the experimental setup, observations, and evaluate the effectiveness of the bromination method.

3. **Project 3: Hydrolysis of Acetamide and Ethyl Benzoate**

Perform hydrolysis reactions to determine the concentrations of acetamide and ethyl benzoate in mixtures. Include a step-by-step procedure, results interpretation, and a discussion on the precision of the hydrolysis method.

4. **Project 4: Complexometric and Mohr's Titrations**

Utilize complexometric titration to measure magnesium using standardized EDTA and perform Mohr's titration to quantify sodium carbonate and bicarbonate in mixtures. Write a comprehensive report on the methodologies, results, and accuracy of the titrations.

References:

1. Sharma, B. K. (2014). Industrial Chemistry (18th ed.). Goel Publishing House.
2. Kent, J. A. (1997). Riegel's Handbook of Industrial Chemistry (9th ed.). CBS Publishers.
3. Prakash, S., Tuli, G. D., & Basu, S. K. (1944). Advanced Inorganic Chemistry - Volume II (pp. 458-463, 830-849). Perfect Paperba

1.6 Skills Enhancement Course

Course Title	Leadership Development Program
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Apply leadership theories and models to enhance their understanding of leadership traits, styles, and behaviors. 2. Explore the impact of different personality types, as per the Five Factor Model, on leadership effectiveness. 3. Examine the applicability and effectiveness of diverse leadership theories, such as Trait, Behavioral, and Contingency theories, in varying organizational contexts. 4. Develop personalized leadership development and succession plans, integrating essential qualities of effective leaders and followers, to foster collaboration and long-term organizational success
Module 1 (Credit 1) - Leadership Fundamentals	
Learning Outcomes	After learning the module, learners will be able to, 1. Apply leadership theories and models to enhance their understanding of leadership traits, styles, and behaviors. 2. Explore the impact of different personality types, as per the Five Factor Model, on leadership effectiveness.
Content Outline	● Traits, styles, skills, behaviors, vision, inspiration and momentum of leadership ● International framework for analyzing leadership ● Personality Types and Leadership ● Five factor model of personality Great Man Theory ● Trait theory ● Behavioral Theories: Michigan studies, Ohio State University studies, Leadership Grid, Role theory ● Contingency Theories: Casual model of Leadership, Normative Decision model, Hersey Blanchard situational model, Vroom & Jago's model,House's Path Goal theory ● Contemporary leadership styles
Module 2 (Credit 1) - Leadership Development Strategies	
Learning Outcomes	After learning the module, learners will be able to, 1. Identify characteristics, types, and methods for evaluating Leadership Development and Leadership Succession. 2. Select appropriate successors, considering emotional aspects and strategies for developing a pool of successors. 3. Assess essential qualities of effective followership and promote collaboration between leaders and followers

Content Outline	• Characteristics, types and evaluation of Leadership Development • Leadership Succession • Choosing a successor, Emotional aspects of leadership succession, developing pool of successors, Follower ship • Essential qualities of effective followers, Collaboration between leaders and followers.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Project 1: Leadership Traits Analysis

Students will select a historical or contemporary leader and analyze their traits, styles, and behaviors. They will apply relevant leadership theories and models learned in the course to interpret the leader's effectiveness. The project will involve presenting findings on how different leadership traits and styles contribute to organizational success. Through this project, students will enhance their understanding of leadership dynamics and their applicability in real-world scenarios.

Project 2: Personality Impact Assessment

Students will conduct a survey or interview to assess how different personality types influence leadership effectiveness. They will explore the impact of personality traits, as per the Five Factor Model, on leadership styles and behaviors. The project will involve analyzing the data collected to draw conclusions about the relationship between personality and leadership. Through this project, students will gain insights into the complexities of leadership and the role of personality in shaping leadership effectiveness.

Project 3: Leadership Theory Application

Students will choose a specific organizational context and apply diverse leadership theories, such as Trait, Behavioral, and Contingency theories, to analyze leadership challenges. They will identify relevant theories and models to address leadership issues and propose solutions. The project will involve presenting recommendations based on the applicability and effectiveness of selected leadership theories. Through this project, students will develop critical thinking skills and practical problem-solving abilities in the field of leadership.

Project 4: Succession Planning Simulation

Students will simulate a leadership succession scenario within a hypothetical organization. They will develop personalized leadership development and succession plans, considering essential qualities of effective leaders and followers. The project will involve role-playing exercises to evaluate emotional aspects of leadership succession and foster collaboration between leaders and followers. Through this project, students will gain hands-on experience in succession planning and develop strategies for ensuring long-term organizational success.

Reference Books:

1. Northouse, P. G. (2015). Leadership (6th ed.). Sage Publications.
2. Lussier, R. N., & Achua, C. F. (2016). Effective Leadership (3rd ed.). Cengage Learning.
3. Daft, R. L. (2015). Leadership. Cengage Learning.
4. Yukl, G. (2016). Leadership in Organizations (6th ed.). Pearson Education

Semester-II

2.1 Major (Core)

Course Title	Aromatic Chemistry
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Apply principles of hybridization and VSEPR theory to predict covalent molecule geometry, distinguishing polar and no polar structures.
	2. Analyze covalent bond polarization factors, including polarizing power and ion polarizability, to understand bond characteristics as per Fajan's rule.
	3. Evaluate dipole moment data to interpret percentage ionic character and deduce molecular structure, assessing characteristics of coordinate covalent compounds and metallic bonds.
	4. Design experiments to investigate preparation methods, structural properties, and reactivity of benzene and aromatic compounds, applying Huckel's rule to discern aromaticity and orientation in substitution reactions.
Module 1 (Credit 1) - Molecular Geometry & Polarity	
Learning Outcomes	After learning the module, learners will be able to
	1. Implement principles of hybridization and VSEPR theory to construct models depicting the geometry of covalent molecules and discern between polar and nonpolar structures.
	2. Formulate experiments to explore covalent bond polarization, considering factors like polarizing power and ion polarizability, to analyze bond characteristics and determine the percentage of ionic character using dipole moment measurements.
Content Outline	• Hybridization and geometry of covalent molecules, including VSEPR theory and differentiation between polar and nonpolar molecules. • Covalent bonds, polarization of covalent bonds, polarizing power, polarizability of ions, Fajan's rule, dipole moment, determination of percentage ionic character from dipole moment, relationship between dipole moment and molecular structure. • Coordinate covalent compounds and their characteristics, metallic bond, free electron model, valence bond theory, band theory, weak chemical bonds including intermolecular and intramolecular hydrogen bonds, and van der Waals forces.
Module 2 (Credit 1) - Aromatic Reactivity & Aromaticity Analysis	
Learning Outcomes	After learning the module, learners will be able to
	1. Examine the structure of benzene, the nomenclature of aromatic compounds, and general methods of preparation, alongside their physical and chemical

	properties.
	2. Scrutinize the reactivity of aromatic compounds through electrophilic and nucleophilic substitution reactions, analyzing orientation in aromatic disubstitution, and determining aromaticity based on Huckel's rule.
Content Outline	• Structure, nomenclature, and general methods of preparation of aromatic compounds. • Physical and chemical properties, including electrophilic and nucleophilic substitution reactions, and orientation in aromatic disubstitution. • Aromaticity, including Huckel's rule, anisotropic ring current, and differentiation of aromatic, nonaromatic, and antiaromatic compounds.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

No Internal Assessment for this course

Reference Books:

1. F. A. Cotton, G. Wilkinson and P. L. Gaus, „Basic Inorganic Chemistry", 5th edition, John Wiley,1987.
2. C. N. R. Rao, ,University General Chemistry", Macmillan, India, 2000.
3. Manas Chanda, „Atomic Structure and Chemical Bond", 4th edition, Tata McGraw-Hill, New Delhi, 2000.

2.6 Open Elective Courses/ Generic (OEC)

Course Title	Science Café
Course Credits	4
Course Outcomes	After going through the course, learners will be able to, 1. Apply principles of nutrition to promote good health. 2. Analyze the composition and properties of nutrients. 3. Evaluate the significance of macro and micro elements. 4. Design balanced dietary plans for optimal health.
Module 1 (Credit 1) - Fundamentals of Nutrition	
Learning Outcomes	After learning the module, learners will be able to, 1. Utilize insights into food functions, nutrition, and nutrients to discern different levels of nutrition and recognize signs of malnutrition. 2. Explore the correlation between nutrition and health, identifying visible signs of well-being and understanding the significance of adhering to food guides for optimal nutrient utilization
Content Outline	• Functions of foods, definition of nutrition, nutrients, adequate optimum and good nutrition, malnutrition. Food as a source of nutrients. • Interrelationship between nutrition and health, visible symptoms of good health. • Food guide-basic five food groups and usage of food guide. Use of food in body-digestion, absorption, transport, and utilization of nutrients in the body.
Module 2 (Credit 1) Water and Energy in Nutrition	
Learning Outcomes	After learning the module, learners will be able to, 1. Examine the role of moisture in food, including concepts like hydrogen bonding, bound water, free water, water activity, and their influence on food stability. 2. Assess the concept of energy, encompassing its unit, food as an energy source, the energy value of food, the body's energy requirements, and the utilization of food for energy needs.
Content Outline	• Water as a nutrient, function, sources, requirement, structure, water balance – effect of deficiency. Introduction to chemistry of water and ice. • Moisture in food: Hydrogen bonding, Bound water, Free water, Water activity and Food stability. • Energy – UNIT of energy, food as a source of energy, energy value of food, the body's need for energy, B.M.R. activities. Utilization of food for energy requirements. Acid – base balance.
Module 3 (Credit 1) - Carbohydrates and Lipids in Food Science	

Learning Outcomes	After learning the module, learners will be able to, 1. Apply knowledge of carbohydrates for dietary analysis. 2. Investigate the role of sweetening agents in food. 3. Assess the properties of lipids for physiological understanding. 4. Develop processes for handling fats and oils in food processing.
Content Outline	● Carbohydrates- composition, classification, sources, functions, structure, physical & chemical properties. ● Other sweetening agents, functions of sugar in food (Browning reaction), changes during cooking and processing. ● Lipids – composition, nomenclature, saturated, unsaturated fatty acids, classification, food sources, functions of fats. Physical and chemical properties, emulsions, chemistry & technology of fat and oil processing. Role of food lipids in flavour
Module 4 (Credit 1) - Minerals and Pigments in Nutrition	
Learning Outcomes	After learning the module, learners will be able to, 1. Utilize knowledge of mineral functions, sources, bio availability, and deficiencies to evaluate the importance of calcium, iron, iodine, fluorine, sodium, and potassium in human health. 2. Examine the pigments indigenous to food, including their structure, chemical and physical properties, and analyze the effects of processing and storage on these pigments. 3. Explore the diversity of flavors present in vegetables, fruits, spices, fermented foods, meats, and seafood, discerning their sensory attributes and culinary applications.
Content Outline	● Mineral functions, sources, Bio-availability, and deficiency of following minerals – calcium, Iron,Iodine, Fluorine, sodium, potassium. ● Pigments indigenous to food, structure, chemical and physical properties. Effect of processing and storage. ● Flavors – Vegetables, fruit and spice flavour, fermented food, Meat and sea food.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1 - Fundamentals of Nutrition

Project: Nutritional Analysis of Daily Diet

Description: Students will conduct a nutritional analysis of their daily diet using readily available online tools or smartphone applications. They will record their food intake for a week and input the data into the software to calculate the intake of macronutrients (carbohydrates, proteins, and fats), micronutrients (vitamins and minerals), and total energy intake. Through analysis, students will identify any deficiencies or excesses in their diet and make recommendations for dietary improvements. This project not only reinforces classroom learning but also equips students with practical skills to make informed dietary choices in their personal and professional lives.

Module 2 - Water and Energy in Nutrition

Project: Water Activity in Common Foods

Description: Students will investigate the concept of water activity in various common food items using easily accessible materials and equipment. They will collect samples of fresh fruits, bread, dried snacks, and other foods from their local grocery store or kitchen. Using a simple homemade water activity meter or by measuring relative humidity, students will determine the water activity of each food sample. Through this hands-on experiment, students will gain insights into the relationship between water activity and food stability, which is crucial for food preservation and safety. This project allows students to apply theoretical knowledge to practical scenarios and enhances their understanding of food science concepts.

Module 3 - Carbohydrates and Lipids in Food Science

Project: Investigating Carbohydrate Content in Everyday Foods

Description: Students will analyze the carbohydrate content of everyday food items using basic qualitative tests that can be performed at home or in a school laboratory. They will select a variety of food samples such as fruits, vegetables, grains, and processed foods from their kitchen or local grocery store. Using simple tests like Benedict's test for reducing sugars and iodine test for starch, students will qualitatively assess the presence of carbohydrates in each food sample. Through this hands-on activity, students will deepen their understanding of carbohydrate composition in foods and its significance in human nutrition. This project fosters practical skills and encourages students to make informed dietary choices based on carbohydrate content.

Module 4 - Minerals and Pigments in Nutrition

Project: Exploring Minerals and Pigments in Everyday Foods

Description: Students will investigate the presence of minerals and pigments in everyday foods through a simple kitchen-based experiment. They will select a variety of fruits, vegetables, grains, and dairy products from their kitchen or local market. Using basic household items like vinegar, iodine solution, and pH paper, students will test for the presence of minerals such as calcium, iron, and potassium, as well as natural pigments like anthocyanins and carotenoids. Through this hands- on exploration, students will gain practical experience in identifying essential nutrients and bioactive compounds in foods. This project not only reinforces classroom learning but also empowers students to make healthier food choices for themselves and others.

References Books:

1. Damodaran, S., Parkin, K. L., & Fennema, D. R. (2007). Fennema’s Food Chemistry (4th ed.). CRC Press.
2. Guthrie, H. A. (1983). Introductory Nutrition (5th ed.). Mosby.
3. Meyer, L. H. (2004). Food Chemistry. Textbook Publishers. ISBN: 0758149204.
4. Mudambi, S. R., Rao, S. M., & Rajagopal, M. V. (2006). Food Science (2nd ed.). New Age International.
5. Mudambi, S. R., & Rajgopal, M. V. (2001). Fundamentals of Foods and Nutrition (4th ed.). New Age International Publishers.
6. Shakuntla, M. N., & Shadaksharaswamy, M. (2013). Food Facts and Principles. New Age International.

2.7 Skill Enhancement Courses (SEC)

Course Title	Personality And Communication
Course Credits	2
Course Outcomes	After going through the course, learners will be able to, 1. Critically analyze Personality constructs, elucidate Determinants of Development, and examine Perception dynamics. 2. Evaluate Factors impacting Association, delineate Personality Traits, and foster Effective Habit formation.] 3. Explore Motivation theories, engage in rigorous Self-Assessment, and implement Emotional Intelligence strategies. 4. Proficiently navigate Effective Communication channels, demonstrate Assertiveness, and exhibit proficient Decision-making prowess
Module 1 (Credit 1) - Leadership and Effective Decision Making	
Learning Outcomes	After learning the module, learners will be able to, 1. Define Personality, explore Determinants of Personality Development, and examine the Perception process to comprehend individual behavior and interactions. 2. Investigate Factors of Association, including Relationship dynamics, Personality Traits, and the development of Effective Habits and Emotional Intelligence for interpersonal effectiveness
Content Outline	• Define Personality, Determinants of Personality Development, Perception-Definition,Perceptual Process • Factors of Association –Relationship, Personality Traits, Developing Effective Habits, Emotional Intelligence, Motivation, Introspection, Self-Assessment, Self-Appraisal & Self-development, Sigmund Freud Id, Ego & SuperEgo • Self Esteem and Maslow, Self Esteem & Erik Erikson, Mind Mapping, Competency Mapping & 360 Degree Assessment, Types of Personalities – Introvert, Extrovert & Ambivert person, Effective Communication & Its key aspects, Assertiveness, Decision making skills, Conflict: Process & Resolution, • Leadership & Qualities of Successful Leader
Module 2 (Credit 1) - Attitude and Stress Management	
Learning Outcomes	After learning the module, learners will be able to, 1. Implement strategies for developing a positive attitude, drawing insights from Carl Jung's contributions to personality development theory. 2. Delve into Stress Management, including an introduction to stress, its causes, and techniques for managing stress effectively. 3. Examine the importance of Time Management, learning various techniques and styles to optimize productivity and efficiency.
Content Outline	• Interpersonal Relationship, Personality – Spiritual journey beyond management of change,Good manners & Etiquettes,Effective Speech, Understanding Body language, projective positive body language.

	• Attitude - Concept -Significance -Factors affecting attitudes – Positive attitude– Advantages–Negative attitude-Disadvantages –Ways to develop positive attitude • Carl Jung 's contribution to personality development theory • Stress Management: Introduction, Causes, stress management techniques • Time management: Importance of time management, Techniques of time management, Time management styles.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Project 1: Personality Development Analysis

Students will critically analyze the constructs of personality and determine the factors influencing personality development. They will conduct a survey to gather data on how different determinants, such as genetics, environment, and experiences, shape personality. The project will also involve an in-depth study of the perception process and how it affects individual behavior and interactions. Students will compile their findings into a detailed report, presenting insights and implications for personal growth.

Project 2: Habit Formation and Emotional Intelligence

Students will evaluate the factors affecting relationships and personality traits to develop effective habits and emotional intelligence. They will create a habit formation plan that incorporates strategies for building positive habits and enhancing emotional intelligence. The project will involvemonitoring their progress over a set period and documenting changes in their interpersonal effectiveness. Students will present their results and reflections in a comprehensive report, highlighting the role of emotional intelligence in personal and professional settings.

Project 3: Motivation and Self-Assessment

Students will explore various motivation theories and engage in self-assessment exercises to understand their motivations and strengths. They will conduct a self-appraisal using tools like mind mapping, competency mapping, and 360-degree feedback to identify areas for self-development. The project will include creating a personal development plan that outlines specific goals and strategies for improving self-esteem and achieving personal growth. Students will present their development plans and the rationale behind their strategies.

Project 4: Communication and Decision-Making Skills

Students will develop and demonstrate effective communication channels and decision-making skills. They will design and implement a communication plan that includes assertive communication techniques and strategies for conflict resolution. The project will involve role- playing scenarios to practice these skills in various contexts, such as workplace settings and personal relationships. Students will document their experiences and evaluate the effectiveness of their communication and decision-making strategies, presenting their findings and reflections in a report.

References Books:

1. Trotter, J. (2022). Perfect Communication: How to Improve Your Communication Skills. Jeffrey Trotter.
2. Dubey, A., & Shukla, A. (2023). Personality Development and Communication Skills. Laxmi Publications Pvt. Ltd.