



SNDT Women's University, Mumbai

**Undergraduate Degree / UG
Programme (Syllabus as Per NEP) -
Faculty of Science & Technology**

(Non-AEDP)

**Bachelor of Science
(Industrial Chemistry)**

B.Sc. (Ind. Chemistry)

As Per NEP – 2020

Semester – I & II

**Syllabus
(W.E.F. Academic Year 2026-27)**

Terminologies

Vertical	Full-Form/Definition	Remarks	Related To Major And Minor Courses
Major (Core)	Subject Comprising Mandatory and Elective Courses, Major Specific IKS, Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects Connected to Major	Minimum 50% Of Total Credits Corresponding to Three/Four - Year UG Degree- Mandatory Courses	Related To The Major
Minor Course	Course From Same Or Different Faculty	Minimum 18-20 Credits to Be Completed in The First Three Years of UG Programme	Related To the Minor
OEC	Open Elective Courses/ Generic Courses	10-12 Credits to Be Offered in I And/Or II Year. Faculty-Wise Baskets of OEC To Be Prepared	OEC Is to Be Chosen Compulsorily from Faculty Other Than That of the Major
VSC	Vocational Skill Courses, Including Hands On Training Corresponding To The Major And/Or Minor Subject	8-10 Credits, To Be Offered in First Three Years, Wherever Applicable Vocational Courses Will Include Skills Based on Advanced Laboratory Practical's of Major	Related To the Major or Minor
SEC	Skill Enhancement Courses	06 Credits, To Be Offered in I And II Year, To Be Selected from The Basket of Skill Courses Approved by University	Related To the Major or Minor Any Relevant Skill
AEC	Ability Enhancement Courses	08 Credits, To Be Offered in I And II Year, English: 04 Credits to Be Earned in Sem - I, Modern Indian Language Of 04 Credits to Be Offered in II Year	NA
VEC	Value Education Courses	Understanding India, Environmental Science/Education, Digital and Technological	NA

		Solutions, Health & Wellness, Yoga Education, Sports, And Fitness	
IKS	Indian Knowledge System	Generic IKS Course: Basic Knowledge Of The IKS To Be Offered At First Year Level	Major-Specific IKS Courses: Advanced Information About the Major, Part of the Major Credit to Be Offered at Second- Or Third-Year Level
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	NA
CE	Community Engagement and Service		Related To Major
RP	Research Project	Corresponding To the Major Subject	Related To Major

Programme Template

Faculty		Science and Technology
Programme		B.Sc.
Specialization		Industrial Chemistry
Preamble		Industrial Chemistry is an interdisciplinary field that applies the principles of chemistry to large-scale industrial processes and the production of chemicals, materials, and products used in everyday life. The program focuses on the practical application of chemical knowledge in industries such as pharmaceuticals, polymers, fertilizers, petrochemicals, food processing, and environmental management. The B.Sc. Industrial Chemistry program is designed to provide students with a strong foundation in chemical sciences along with an understanding of industrial processes, chemical manufacturing, quality control, and safety practices. It integrates theoretical knowledge with laboratory training and industrial exposure to develop technical skills and problem-solving abilities. The program aims to prepare students for careers in chemical and allied industries, research laboratories, environmental sectors, and quality assurance departments, while also encouraging innovation, sustainability, and responsible industrial practices.
Programme Specific Outcomes (PSOs)		After completing this program, the learner will be able to,
	1	Understand Industrial Chemical Processes: Apply fundamental concepts of chemistry to understand various industrial manufacturing processes and chemical production methods.
	2	Operate Laboratory and Industrial Equipment: Demonstrate practical skills in handling laboratory instruments, chemical reactors, and analytical equipment used in chemical industries.
	3	Apply Analytical and Quality Control Techniques: Perform chemical analysis and quality control procedures to ensure the quality and safety of industrial products.
	4	Understand Chemical Safety and Environmental Management: Identify industrial hazards and apply safety measures, waste management practices, and environmental protection principles.
	5	Apply Knowledge of Industrial Materials: Understand the chemistry of polymers, fuels, dyes, fertilizers, pharmaceuticals, and other industrial chemicals.

	6	Develop Problem-Solving and Research Skills: Analyze industrial problems and apply scientific methods and research skills to find effective solutions.
	7	Enhance Employability and Professional Skills: Demonstrate communication, teamwork, and technical skills required for employment in chemical industries, research laboratories, and related sectors.
Eligibility Criteria for Programme		12th Standard (Science Stream)
Intake		60

Structure with Course Titles

B. Sc. (Industrial Chemistry) (Non-AEDP)

Semester - I

SN	Courses	Type of Course	Credits	Marks	Int Marks	Ext Marks
	Semester – I					
10132701	Fundamentals of Industrial Chemistry-I (Th)	Major (Core)	2	50	50	0
		Major (Core)	2	50	50	0
		Major (Core)	2	50	50	0
10432711	Industrial Environmental Management (Th)	OEC	4	100	50	50
10632701	Industrial Chemistry (Pr)	VSC S1	2	50	50	0
10732711	Production of Biofertilizer or Organic Compost (Th)	SEC	2	50	0	50
	Ability Enhancement Course (AEC) Link: https://sndt.ac.in/pdf/academics/syllabus-as-per-nep/aec-syllabus/ug-degree/ability-enhancement-course.pdf (Available on Website)	AEC (English) (Any One)	2	50	0	50
10810111	English For Academic Writing-Paper I (For Students of English Medium)					
10810112	English Language and Literature-I (For Students of Non-English medium)					
11051111	Inception of India Knowledge System	IKS (Generic)	2	50	0	50

	IKS Link: https://www.sndt.ac.in/pdf/academics/syllabus-as-per-nep/iks-syllabus/ug-degree/inception-of-indian-knowledge-system.pdf (Available on Website)					
10952111	Introduction to Indian Constitution Link: https://www.sndt.ac.in/pdf/academics/syllabus-as-per-nep/vec-syllabus/ug-degree/introduction-to-indian-constitution.pdf (Available on Website)	VEC	2	50	0	50
	Co-Curricular Course (CC) Link: https://www.sndt.ac.in/pdf/academics/syllabus-as-per-nep/cc-syllabus/ug-degree/co-curricular-course-as-per-nep-2020-semester-i-syllabus.pdf (Available on Website)	CC (Any One)	2	50	50	0
11450121	Basics of National Service Scheme					
11450221	National Cadets Corps. (NCC) Studies-I					
11450322	Health and Wellness					
11450421	Performing Arts Exploration					
			22	550	300	250

B. Sc. (Industrial Chemistry) (Non-AEDP)**Semester – II**

SN	Courses	Type of Course	Credits	Marks	Int Marks	Ext Marks
	Semester - II					
20132711	Fundamentals of Industrial Chemistry-II (Th)	Major (Core)	2	50	0	50
		Major (Core)	2	50	0	50
		Major (Core)	2	50	0	50
		VSC S2	2	50	50	0
		VSC S3	2	50	50	0
20432711	Petrochemicals and Fuels (Th)	OEC	4	100	50	50
20732701	Cosmetic and Household Product Formulation (Th)	SEC	2	50	50	0
	Ability Enhancement Course (AEC) Link: https://www.sndt.ac.in/pdf/academics/syllabus-as-per-nep/aec-syllabus/ug-degree/ability-enhancement-course.pdf (Available on Website)	AEC (English) (Any One)	2	50	0	50
20810111	English For Academic Writing-Paper II (For Students of English Medium)					
20810112	English Language and Literature-II (For Students of Non-English medium)					
20952111	Environment Awareness Link:	VEC	2	50	0	50

	https://www.sndt.ac.in/pdf/academics/syllabus-as-per-nep/vec-syllabus/ug-degree/environment-awareness.pdf (Available on Website)					
	Co-Curricular Course (CC) Link: https://www.sndt.ac.in/pdf/academics/syllabus-as-per-nep/cc-syllabus/ug-degree/co-curricular-course-as-per-nep-2020-semester-ii-syllabus.pdf (Available on Website)	CC (Any One)	2	50	50	0
21450121	Volunteerism and National Service Scheme					
21450221	National Cadets Corps. (NCC) Studies-II					
21450323	Yoga Education					
21450421	Fine Art					
			22	550	250	300

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

Course Syllabus

Semester – I

.1.1 Major (Core)

Course Titles	Fundamentals of Industrial Chemistry-I (Th)
Course Credits	2 Credit's
Course Outcomes	After going through the course, learners will be able to
	1. Explain the fundamental principles of chemistry and their applications in various chemical industries.
	2. Describe atomic structure, periodic classification of elements, and different types of chemical bonding relevant to industrial compounds.
Module 1 (Credit 1) – Basics of Inorganic and Physical Chemistry	
Learning Outcomes	After learning the module, learners will be able to,
	1. Students will be able to understand the basic principles of inorganic chemistry including atomic structure, periodic classification, chemical bonding, and properties of acids, bases, and salts.
	2. Students will be able to explain the concept of coordination compounds and identify their applications in daily life and industrial processes.
Content Outline	• Introduction to inorganic chemistry and periodic classification of elements. Atomic structure and periodic properties of elements. Types of chemical bonding (ionic and covalent bonding). Basic concepts of acids, bases, and salts. Introduction to coordination compounds and their applications. Chemical kinetics, factors affecting the rate of reaction, enzyme catalysis, applications of catalysis in industry and biological systems.
Module 2 (Credit 1) – Basics of Industrial Chemistry	
Learning Outcomes	After learning the module, learners will be able to,
	1. Students will be able to explain the scope of industrial chemistry and classify different types of chemical industries based on their products and processes.
	2. Students will be able to identify important raw materials used in chemical industries and understand the basic concepts of industrial chemical processes and unit operations.
Content Outline	• Introduction and scope of industrial chemistry. Classification of chemical industries. Raw materials used in chemical industries and their sources. Basic idea of industrial chemical processes and unit operations.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1 – Basics of Inorganic Chemistry

Project 1: Study of Coordination Compounds and Their Applications

Description:

Students will prepare charts or models showing the structure of simple coordination compounds and study their applications in fields such as medicine, agriculture, and industry. They will also observe the color and properties of selected inorganic compounds and prepare a short report explaining their uses and.

Module 2 – Basics of Industrial Chemistry

Project 1: Identification of Raw Materials Used in Chemical Industries

Description:

Students will study various natural and synthetic raw materials used in chemical industries such as minerals, petroleum products, plant-based materials, and salts. They will prepare a short report explaining their sources and applications in industrial production.

Reference Books: -

1. Lee, J. D. *Concise Inorganic Chemistry*, 5th Ed., Wiley India Pvt. Ltd., New Delhi, 2008.
2. Housecroft, C. E., & Sharpe, A. G. *Inorganic Chemistry*, 5th Ed., Pearson Education Limited, Harlow, England, 2018.
3. Sharma, B. K. *Industrial Chemistry (Including Chemical Engineering)*, 17th Ed., Goel Publishing House, Meerut, India, 2020.
4. Austin, G. T. *Shreve's Chemical Process Industries*, 5th Ed., McGraw-Hill International Book Company, New York, 1984.
5. Rao, M. G., & Sittig, M. *Dryden's Outlines of Chemical Technology*, 2nd Ed., East-West Press Pvt. Ltd., New Delhi, 1997.
6. Jain, P. C., & Jain, M. *Engineering Chemistry*, 18th Ed., Dhanpat Rai Publishing Company, New Delhi, 2023.

Semester – I

.1.4 Vocational Skill Courses (VSC-S1)

Course Titles	Industrial Chemistry (Pr)
Course Credits	2 Credit's
Course Outcomes	After going through the course, learners will be able to
	1. Perform laboratory experiments related to industrial chemistry using appropriate techniques, instruments, and safety practices to analyze industrial chemicals and processes.
	2. Interpret experimental observations, analyze data, and prepare scientific reports to understand the practical applications of industrial chemistry in chemical industries.
Module 1 (Credit 1) – Industrial Chemistry	
Learning Outcomes	After learning the module, learners will be able to,
	1. Perform quantitative chemical analyses using volumetric and complexometric titration techniques for the determination of sodium hydroxide, alkalinity, iron content, hardness, and other physicochemical parameters of water samples.
	2. Interpret analytical results and assess water quality by estimating total solids, dissolved solids, chloride, and sulphate content, and relate the findings to industrial quality control and environmental applications.
Content Outline	• Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard) • Determination of Alkalinity (Carbonate and Hydroxide) of water sample • Determination of percentage of Iron in the given rust solution by external indicator method • Determination of total Hardness of Water sample by EDTA method, Total solids, Dissolved solids, Chloride and sulphate.
Module 2 (Credit 1) – Inorganic Chemistry	
Learning Outcomes	After learning the module, learners will be able to,
	1. Demonstrate practical skills in the synthesis and analysis of industrially important compounds by preparing products such as benzoic acid, neriolin, soap, copper pigments, and phenol-formaldehyde resin, and by detecting extra elements and analyzing organic compounds.
	2. Apply laboratory techniques and safety practices to interpret experimental results, evaluate the quality and characteristics of prepared products, and understand their industrial significance and applications.
Content Outline	• Preparation of Benzoic Acid • Preparation of Neriolin

	• Detection of extra elements • Analysis of Compounds • Preparation of Soap • Preparation of Copper Pigments • Preparation of Phenol-Formaldehyde Resin
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Reference:

1. Vogel, A. I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, Harlow, 1989.
2. Vogel, A. I. *Vogel's Qualitative Inorganic Analysis*, 7th Ed., Longman Scientific & Technical, Harlow, 1989.
3. Pass, G., and Sutcliffe, H. *Practical Chemistry*, 2nd Ed., Pergamon Press, Oxford, 1974.
4. Chatwal, G. R., and Anand, S. K. *Instrumental Methods of Chemical Analysis*, 6th Ed., Himalaya Publishing House, Mumbai, 2022.
5. APHA, AWWA, and WEF. *Standard Methods for the Examination of Water and Wastewater*, 24th Ed., APHA Press, Washington, D.C., 2023.
6. Sharma, B. K. *Industrial Chemistry (Including Chemical Engineering)*, 17th Ed., Goel Publishing House, Meerut, 2020.

Semester – I

.1.5 OEC

Course Titles	Industrial Environmental Management (Th)
Course Credits	4 Credit's
Course Outcomes	After going through the course, learners will be able to
	1. Apply the principles of industrial environmental management to identify, assess, and control industrial pollution using appropriate waste management and pollution control techniques.
	2. Evaluate environmental management systems, environmental legislation, and sustainable industrial practices to promote cleaner production, resource conservation, and regulatory compliance.
Module 1 (Credit 1) – Fundamentals of Industrial Environment and Pollution	
Learning Outcomes	After learning the module, learners will be able to,
	1. Identify various industrial pollutants and their sources.
	2. Describe the importance of sustainable industrial development and environmental protection.
Content Outline	• Environment: Concept, components, and ecosystem. Industrialization and environmental degradation. Types and sources of industrial pollution. Air, water, soil, noise, and thermal pollution. Environmental quality parameters. Sustainable development and circular economy. Environmental ethics and industrial responsibility.
Module 2 (Credit 1) – Industrial Waste Management and Pollution Control	
Learning Outcomes	After learning the module, learners will be able to,
	1. Classify industrial wastes and recommend suitable treatment methods.
	2. Explain the working principles of pollution control equipment.
Content Outline	• Industrial solid waste: classification and management. Hazardous waste management. Industrial wastewater treatment (primary, secondary, and tertiary treatment). Air pollution control equipment. Noise pollution control methods. Cleaner production technologies. Waste minimization and 3R principles (Reduce, Reuse, Recycle).
Module 3 (Credit 1) – Environmental Monitoring and Environmental Management Systems	
Learning Outcomes	After learning the module, learners will be able to,
	1. Conduct basic environmental monitoring using standard methods.

	2. Describe the significance of environmental auditing and ISO 14001 certification.
Content Outline	Environmental monitoring: objectives and methods. Monitoring of air, water, and noise pollution. Environmental Impact Assessment (EIA): concept and procedure. Environmental Management System (EMS). ISO 14001 standards. Environmental auditing. Carbon footprint and water footprint (basic concepts).
Module 4 (Credit 1) – Environmental Legislation and Sustainable Industrial Practices	
Learning Outcomes	After learning the module, learners will be able to,
	1. Explain the major environmental laws governing industrial operations.
	2. Evaluate sustainable technologies for improving industrial environmental performance.
Content Outline	Environmental legislation in India. Water (Prevention and Control of Pollution) Act, 1974. Air (Prevention and Control of Pollution) Act, 1981. Environment (Protection) Act, 1986. Hazardous and Other Wastes (Management and Transboundary Movement) Rules. Green chemistry and cleaner technologies. Renewable energy in industries. Corporate Social Responsibility (CSR) and industrial sustainability. Case studies on sustainable industries.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1 – Fundamentals of Industrial Environment and Pollution

Project 1: Environmental Survey of Local Industries

Description:

Students will conduct a survey of nearby industries to identify potential sources of environmental pollution. The survey should include observations on air emissions, wastewater discharge, solid waste generation, and pollution control measures. A report with photographs (where permitted), findings, and recommendations should be submitted.

Module 2 – Industrial Waste Management and Pollution Control

Project 1: Industrial Waste Characterization

Description:

Students will collect information from a selected industry regarding waste generation and prepare a waste management plan. The project should include waste classification, disposal methods, recycling opportunities, and recommendations for waste minimization.

Module 3 – Environmental Monitoring and Environmental Management Systems

Project 1: Water Quality Analysis

Description:

Students will collect water samples from nearby industrial or municipal sources and analyze parameters such as pH, turbidity, hardness, alkalinity, TDS, and chloride using standard laboratory methods. The results will be compared with BIS/WHO standards, followed by a report and recommendations.

Module 4 – Environmental Legislation and Sustainable Industrial Practices

Project 1: Green Industry Case Study

Description:

Students will study an industry recognized for sustainable environmental practices and prepare a report highlighting its pollution control measures, waste management strategies, renewable energy utilization, CSR initiatives, and compliance with environmental regulations. The findings should be presented through a seminar or poster.

Reference Books

1. Bharucha, E. (2024). *Textbook of Environmental Studies for Undergraduate Courses* (3rd ed.). Universities Press.
2. De, A. K. (2022). *Environmental Chemistry* (9th ed.). New Age International Publishers.
3. Rao, C. S. (2022). *Environmental Pollution Control Engineering*. New Age International Publishers.
4. Tchobanoglous, G., Stensel, H. D., Tsuchihashi, R., & Burton, F. (2023). *Wastewater Engineering: Treatment and Resource Recovery* (6th ed.). McGraw-Hill Education.
5. Manahan, S. E. (2022). *Environmental Chemistry* (11th ed.). CRC Press.
6. Rajagopalan, R. (2023). *Environmental Studies: From Crisis to Cure* (4th ed.). Oxford University Press.
7. Cunningham, W. P., & Cunningham, M. A. (2024). *Principles of Environmental Science* (10th ed.). McGraw-Hill Education.
8. Masters, G. M., & Ela, W. P. (2023). *Introduction to Environmental Engineering and Science* (4th ed.). Pearson.

Semester – I

.1.6 Skill Enhancement Courses (SEC)

Course Titles	Production of Biofertilizer or Organic Compost (Th)
Course Credits	2 Credit's
Course Outcomes	After going through the course, learners will be able to
	1. Explain the principles, production methods, and applications of biofertilizers and organic compost for sustainable agriculture.
	2. Practical skills in preparing organic compost, applying biofertilizers, evaluating their quality, and assessing their impact on plant growth through project-based learning.
Module 1 (Credit 1) – Fundamentals of Biofertilizers and Organic Compost	
Learning Outcomes	After learning the module, learners will be able to,
	1. Explain the principles, types, and importance of biofertilizers and organic compost in sustainable agriculture.
	2. Prepare organic compost using suitable composting techniques and monitor the composting process.
Content Outline	Introduction to sustainable agriculture and organic farming. Concept, importance, and advantages of biofertilizers and organic compost. Types of biofertilizers: Rhizobium, Azotobacter, Azospirillum, Phosphate Solubilizing Bacteria (PSB), Blue-Green Algae (BGA), and Mycorrhiza. Organic compost: definition, composition, and nutrient value. Raw materials used for compost preparation. Composting methods: aerobic, anaerobic, vermicomposting, and NADEP composting. Factors affecting composting: moisture, aeration, temperature, pH, and carbon-to-nitrogen (C:N) ratio. Environmental and economic benefits of biofertilizers and compost.
Module 2 (Credit 1) – Production, Quality Control, and Applications of Biofertilizers	
Learning Outcomes	After learning the module, learners will be able to,
	1. Describe the production process, quality control, and storage of biofertilizers.
	2. Demonstrate the application of biofertilizers and evaluate their effectiveness in promoting plant growth.
Content Outline	Production technology of biofertilizers. Isolation and cultivation of beneficial microorganisms (basic concepts). Carrier materials used in biofertilizer production. Mass multiplication, formulation, packaging, storage, and shelf life. Quality control parameters for biofertilizers. Methods of biofertilizer application: seed treatment, seedling dip, and soil application. Integrated Nutrient Management (INM). Government initiatives and quality standards for biofertilizers and organic farming. Future

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1 – Fundamentals of Biofertilizers and Organic Compost

Project 1: Preparation of Organic Compost

Description:

Students will prepare organic compost using biodegradable kitchen waste, garden waste, or agricultural residues. The project will include:

- Selection and segregation of raw materials.
- Preparation of compost pit/bin.
- Monitoring moisture, temperature, and decomposition process.
- Recording observations throughout the composting period.
- Evaluation of the maturity and quality of the final compost.
- Submission of a project report with photographs and observations.

Module 2 – Production, Quality Control, and Applications of Biofertilizers

Project 1: Preparation and Evaluation of a Biofertilizer-Based Pot Trial

Description:

Students will conduct a pot experiment to compare plant growth under different nutrient treatments, such as:

- Control (no fertilizer)
- Organic compost
- Biofertilizer
- Combination of compost and biofertilizer

Students will record germination percentage, plant height, number of leaves, biomass, and overall plant health. Results will be analyzed and presented in a report with tables, graphs, and conclusions.

Reference Books

1. Subba Rao, N. S. (2023). *Biofertilizers in Agriculture and Forestry* (Latest Indian Edition). MedTech Science Press.
2. Kannaiyan, S., Kumar, K., & Govindarajan, K. (2022). *Biofertilizers Technology*. Scientific Publishers, Jodhpur.
3. Sathe, T. V. (2022). *Vermiculture and Organic Farming*. Daya Publishing House.
4. Gaur, A. C. (2022 Reprint). *A Manual of Rural Composting*. Oxford & IBH Publishing.
5. Trivedi, P. C. (2023). *Organic Farming and Biofertilizers*. Pointer Publishers.
6. ICAR (Indian Council of Agricultural Research). (2023). *Handbook of Agriculture*. ICAR Publications, New Delhi.
7. Yadav, D. S., & Sarkar, S. (2023). *Organic Farming: Principles and Practices*. New India Publishing Agency.

8. Singh, J., & Seneviratne, G. (2024). *Biofertilizers and Sustainable Agriculture*. Springer Nature.

Course Syllabus

Semester – II

.2.1 Major (Core)

Course Titles	Fundamental of Industrial Chemistry-II (Th)
Course Credits	2 Credit's
Course Outcomes	After going through the course, learners will be able to
	1. Understand the characteristics and industrial significance of acids, bases, salts, and other inorganic substances.
	2. Describe the basic concepts, structures, and applications of coordination compounds in different industries.
Module 1 (Credit 1) – Basics of Organic Chemistry	
Learning Outcomes	After learning the module, learners will be able to,
	1. Students will be able to explain the scope of organic chemistry, hybridization of carbon, and the structure and bonding in organic compounds.
	2. Students will be able to classify and name organic compounds using IUPAC nomenclature and identify functional groups and homologous series in hydrocarbons.
Content Outline	• Introduction and scope of organic chemistry. Structure and bonding in organic compounds with special reference to hybridization of carbon. Classification and nomenclature of organic compounds. Concept of functional groups and homologous series. Basic study of hydrocarbons (alkanes, alkenes, and alkynes) including their properties and simple reactions.
Module 2 (Credit 1) – Industrial Chemistry	
Learning Outcomes	After learning the module, learners will be able to,
	1. Students will be able to explain the basic concepts involved in the industrial production, properties, and applications of important chemicals such as acids, alkalis, and fertilizers.
	2. Students will be able to understand the role of chemical industries in agriculture, pharmaceuticals, and food sectors, along with their environmental impacts and pollution control measures.
Content Outline	• Basic concept of industrial production of important chemicals. Manufacture and applications of industrial products such as acids, alkalis, and fertilizers. Role of chemical industries in agriculture, pharmaceuticals, and food industries. Environmental impact of chemical industries and basic methods of pollution control.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1 – Basics of Organic Chemistry

Project 1: Identification of Functional Groups in Organic Compounds

Description: Students will collect or observe common organic compounds (such as alcohols, acids, aldehydes, and hydrocarbons) and identify their functional groups. They will prepare a chart showing different functional groups, their structures, and examples with applications.

Module 2 – Industrial Chemistry

Project 1: Study of Industrial Chemicals and Their Applications

Description: Students will prepare a detailed chart or report on industrially important chemicals such as sulfuric acid, nitric acid, sodium hydroxide, and fertilizers. The project will include their manufacturing process, uses in agriculture, pharmaceuticals, and food industries, and their importance in daily life.

Reference:

1. Morrison, R. T., & Boyd, R. N. *Organic Chemistry*, 7th Ed., Pearson Education India, New Delhi, 2011.
2. Finar, I. L. *Organic Chemistry, Volume I: The Fundamental Principles*, 6th Ed., Pearson Education India, New Delhi, 2006.
3. Solomons, T. W. G., Fryhle, C. B., & Snyder, S. A. *Fundamentals of Organic Chemistry*, 13th Ed., John Wiley & Sons, Hoboken, NJ, 2022.
4. Sharma, B. K. *Industrial Chemistry (Including Chemical Engineering)*, 17th Ed., Goel Publishing House, Meerut, 2020.
5. Austin, G. T. *Shreve's Chemical Process Industries*, 5th Ed., McGraw-Hill International Book Company, New York, 1984.
6. De, A. K. *Environmental Chemistry*, 9th Ed., New Age International Publishers, New Delhi, 2022.

Semester – II

.2.6 Open Elective Courses (OEC)

Course Titles	Petrochemicals and Fuels (Th)
Course Credits	4 Credit's
Course Outcomes	After going through the course, learners will be able to
	1. Explain the origin, refining, processing, and industrial applications of petroleum, petrochemicals, and fuels.
	2. Analyze petrochemical manufacturing processes, classify petrochemical products, and understand their industrial significance.
Module 1 (Credit 1) – Introduction to Petroleum and Petrochemical Industry	
Learning Outcomes	After learning the module, learners will be able to,
	1. Explain the origin, composition, refining process, and products of petroleum.
	2. Describe the role of the petrochemical industry in manufacturing essential industrial chemicals.
Content Outline	• Introduction to petroleum: origin, occurrence, and composition. Classification and characteristics of crude oil. Exploration, drilling, extraction, and transportation of crude oil. Petroleum refining: overview and importance. Fractional distillation of crude oil. Major petroleum fractions and their industrial applications. Introduction to the petrochemical industry and feedstocks. Major petrochemical products and their uses.
Module 2 (Credit 1) – Petrochemical Processes and Products	
Learning Outcomes	After learning the module, learners will be able to,
	1. Explain major petrochemical manufacturing processes and products.
	2. Classify petrochemical products based on their industrial applications.
Content Outline	• Feedstocks for petrochemical industries. Cracking processes: thermal cracking and catalytic cracking. Reforming, alkylation, isomerization, and polymerization. Production of olefins and aromatics. Manufacture and applications of ethylene, propylene, butadiene, benzene, toluene, and xylene. Petrochemical products: plastics, synthetic rubber, synthetic fibres, detergents, solvents, and fertilizers. Industrial safety in petrochemical plants.
Module 3 (Credit 1) – Fuels and Fuel Technology	
Learning Outcomes	After learning the module, learners will be able to,
	1. Differentiate between conventional and renewable fuels based

	on their properties and applications.
	2. Evaluate fuel quality parameters and recommend suitable fuels for different applications.
Content Outline	Definition, classification, and characteristics of fuels. Calorific value and fuel efficiency. Solid, liquid, and gaseous fuels. Conventional fuels: coal, petrol, diesel, kerosene, LPG, and CNG. Alternative and renewable fuels: biodiesel, bioethanol, biogas, and hydrogen fuel. Fuel quality parameters. Fuel additives and octane/cetane numbers. Storage, handling, and safety of fuels.
Module 4 (Credit 1) – Environmental Impact, Energy Conservation, and Sustainability	
Learning Outcomes	After learning the module, learners will be able to,
	1. Explain the environmental impacts of fuel utilization and strategies for pollution control.
	2. Recommend energy conservation measures and sustainable fuel technologies for industrial and domestic applications.
Content Outline	Environmental impact of petroleum refining and fuel combustion. Air pollution due to fossil fuels. Greenhouse gases and global warming. Cleaner fuels and emission control technologies. Energy conservation methods in industries. Carbon footprint and energy efficiency. Sustainable fuel technologies. Government policies on clean energy and biofuels (overview). Future prospects of the hydrogen economy and green fuels.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1 – Introduction to Petroleum and Petrochemical Industry

Project 1: Study of a Petroleum Refinery

Description: Students will prepare a case study on an Indian petroleum refinery (e.g., Indian Oil, BPCL, HPCL, Reliance Industries). The report should include crude oil processing, refining operations, products manufactured, environmental management practices, and economic importance.

Module 2 – Petrochemical Processes and Products

Project 1: Petrochemical Product Survey

Description: Students will identify and classify common petrochemical products used in homes, industries, and laboratories. The project should include raw materials, the manufacturing process (flow chart), applications, recycling methods, and environmental concerns.

Module 3 – Fuels and Fuel Technology

Project 1: Comparative Study of Conventional and Alternative Fuels

Description: Students will compare different fuels based on calorific value, cost, emissions, availability, efficiency, and environmental impact. The study may include data collection from published sources and presentation of results using tables, graphs, and charts.

Module 4 – Environmental Impact, Energy Conservation, and Sustainability

Project 1: Energy Audit and Fuel Conservation Survey

Description: Students will conduct an energy-use survey of a household, institution, or small industry. They will identify energy consumption patterns, estimate fuel usage, recommend conservation measures, and prepare an energy audit report highlighting opportunities for improving energy efficiency.

Reference Books

1. Speight, J. G. (2023). *The Chemistry and Technology of Petroleum* (6th ed.). CRC Press.
2. Speight, J. G. (2023). *Handbook of Petroleum Refining* (3rd ed.). CRC Press.
3. Gary, J. H., Handwerk, G. E., & Kaiser, M. J. (2022). *Petroleum Refining: Technology and Economics* (6th ed.). CRC Press.
4. Bhaskararao, B. K. (2022). *Modern Petroleum Refining Processes*. Oxford & IBH Publishing.
5. Sarkar, S. (2022). *Fuels and Combustion* (4th ed.). Universities Press.
6. Nag, P. K. (2023). *Power Plant Engineering* (5th ed.). McGraw-Hill Education. (Relevant chapters on fuels and combustion.)
7. Meyers, R. A. (2023). *Handbook of Petrochemicals Production Processes*. McGraw-Hill.
8. Ministry of Petroleum and Natural Gas, Government of India. (Latest publications). *Reports on Petroleum, Natural Gas, Biofuels, and Energy Policies*.

Semester – II

.2.7 Skill Enhancement Courses (SEC)

Course Titles	Cosmetic and Household Product Formulation (Th)
Course Credits	2 Credit's
Course Outcomes	After going through the course, learners will be able to
	1. Develop and formulate basic cosmetic and household products such as soaps, shampoos, hand sanitizers, and detergents using appropriate raw materials and standard manufacturing practices.
	2. Perform quality evaluation of cosmetic and household products, apply safety and regulatory guidelines, and assess their potential for small-scale industrial production and entrepreneurship.
Module 1 (Credit 1) – Formulation of Cosmetic Products	
Learning Outcomes	After learning the module, learners will be able to,
	1. Explain the role of ingredients and formulation principles used in cosmetic products.
	2. Prepare basic cosmetic formulations such as soap, shampoo, and hand sanitizer following Good Manufacturing Practices.
Content Outline	• Introduction to cosmetics: definition, classification, and applications. Raw materials used in cosmetics: surfactants, oils, fats, waxes, emulsifiers, humectants, preservatives, fragrances, colours, and antioxidants. Principles of formulation and Good Manufacturing Practices (GMP). Preparation of toilet soap and liquid hand wash. Shampoo formulation: ingredients, formulation methods, and manufacturing process. Hand sanitizer: types, composition, formulation, and WHO-recommended alcohol-based sanitizer. Packaging, labeling, storage, and safety requirements for cosmetic products.
Module 2 (Credit 1) – Household Product Formulation and Quality Evaluation	
Learning Outcomes	After learning the module, learners will be able to,
	1. Formulate household cleaning products and evaluate their quality using standard laboratory tests.
	2. Demonstrate safe manufacturing, packaging, and labeling practices while recognizing entrepreneurship opportunities in the cosmetic and household products sector.
Content Outline	• Introduction to household cleaning products. Formulation of detergents: ingredients, manufacturing process, and applications. Preparation of liquid detergent, dishwashing liquid, and floor cleaner (basic formulations). Quality evaluation of cosmetic and household products: pH determination, foam stability, cleaning efficiency, viscosity (basic concept),

	appearance, colour, fragrance, and stability. Packaging materials and labeling requirements. Safety, environmental aspects, and regulatory guidelines (BIS and basic cosmetic regulations). Entrepreneurship opportunities in cosmetic and household product manufacturing.
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Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1 – Formulation of Cosmetic Products

Project 1: Preparation of Herbal Soap and Alcohol-Based Hand Sanitizer

Description: Students will formulate a herbal bathing soap using natural additives (e.g., aloe vera, neem, or turmeric extract) and prepare an alcohol-based hand sanitizer according to standard guidelines. They will evaluate the products for appearance, pH, texture, fragrance, and user acceptability, and submit a report with formulation details, observations, and safety precautions.

Module 2 – Household Product Formulation and Quality Evaluation

Project 1: Formulation and Quality Evaluation of Liquid Detergent

Description: Students will prepare a liquid detergent using standard laboratory procedures and evaluate its pH, foam stability, cleaning efficiency, viscosity (where facilities are available), and storage stability. A comparative study with a commercial product may also be carried out. Students will prepare a technical report including formulation, test results, cost estimation, and recommendations.

Reference Books

1. Barel, A. O., Paye, M., & Maibach, H. I. (2023). *Handbook of Cosmetic Science and Technology* (5th ed.). CRC Press.
2. Mitsui, T. (2022). *New Cosmetic Science*. Elsevier.
3. Harry, R. G. (2023). *Harry's Cosmetology* (Latest Indian Reprint). Chemical Publishing Company.
4. Saraf, S., & Kaur, C. D. (2022). *Cosmetics: Formulation, Manufacturing and Quality Control*. CBS Publishers & Distributors.
5. Poucher, W. A. (2023). *Poucher's Perfumes, Cosmetics and Soaps* (11th ed.). Springer.
6. Sharma, P. P. (2022). *Cosmetics: Formulation, Manufacturing and Quality Control*. Vandana Publications.
7. Indian Standards (BIS). (Latest editions). *Standards for Soaps, Detergents, and Cosmetic Products*. Bureau of Indian Standards, New Delhi.
8. World Health Organization (WHO). (Latest update). *Guide to Local Production: WHO-Recommended Handrub Formulations*.