(Bachelor of Science) (Undergraduate) (Industrial Chemistry Vocational)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Major)	**US05MAICV01**	Title of the Course	**Organic Chemistry**
Total Credits of the Course	4	Hours per Week	4

Course Objectives	To make students familiar with: 1. Heterocyclic Chemistry and polynuclear hydrocarbon. 2. Various name reaction and reagents utilized for chemical reactions in the industries. 3. The basics of spectroscopy and its application in organic chemical analysis.

Course Content		
Unit	**Description**	**Weightage*(%)**
1.	**Heterocyclic Chemistry**: Nomenclature of heterocyclic systems (Five and Six membered only), Five membered heterocycles- structure, source and electrophilic substitution reaction in Pyrrole, Thiophene and furan. Six membered heterocyclic compounds: structure and source of pyridine compounds, nucleophilic and electrophilic substitution reaction in pyridine, basicity of pyridine, reduction of pyridine. Fused ring heterocycles- Skraup synthesis of Quinoline, Bischler-Nspierlaski synthesis of isoquinoline, Fischer indolesynthesis.	**25%**
2.	**Polynuclear hydrocarbon**: Introduction, Nomenclature, Structure, preparation and reaction of Naphthalene, anthracene and Phenanthrene.	**25%**
3.	**Some Reagents Of Synthetic Importance**: Aluminium isopropoxide, Diazomethane, N-Bromosuccinimide, Lead tetra acetate, Osmium tetraoxide, Selenium dioxide, LiAlH4 and NaBH4. **Reaction Mechanism**:, Hoffmann- Loffler Reaction, Baeyer Villiger Oxidation, Hunsdiecker Reaction, Favorskii Rearrangement, Benzoin Condensation ,**Concept of rearrangement** - Beckman Rearrangement, Benzilic acid Rearrangement and Pinacol-Pinacolone rearrangement.	**25%**
4.	**Ultraviolet (UV) and Visible Spectroscopy**: An Introduction, electronic transitional definition of some terms and designation of UV absorption bands. **Infrared Spectroscopy**: An introduction, Instrumentations, Applications of IR spectroscopy, Interpretation of IR spectra- characterization of functional groups and structural diagnosis. **NMR Spectroscopy**: PMR spectroscopy, shielding and deshielding , chemical shift, spin-spin splitting and coupling constant, area of signal, interpretation of PMR spectra of various simple organic molecules, Problems pertaining to the structure elucidation of organic compounds using UV, IR, Mass and PMRspectroscopy.	**25%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry Vocational programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per NEP – 2020)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per NEP – 2020)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to

1.	Students will learn Heterocyclic Chemistry and polynuclear hydrocarbon.
2.	Learn about various name reaction and reagents utilized for chemical reactions having direct applicability in the industries.
3.	Students will get exposed to the basics of spectroscopy and its application in organic chemical analysis.

Suggested References:

Sr. No.	References
1.	Organic Chemistry by Robert T. Morrison and Robert T. Boyd (VIth Edition, Prentice Hall of India Pvt. Ltd. NewDelhi)
2.	Organic Chemistry by R. K. Bansal (Tata McGraw – Hill Publishing Co. Ltd. New Delhi)
3.	Organic Chemistry by M. K. Jain and S. C. Jain (ShobanLAlNagin Chand & Co. Educational Publishers,Jalandhar).
4.	Spectroscopy of Organic Compounds by P. S. Kalsi (New Age International Publishers)
5.	Spectroscopy (Atomic & Molecular) by GurdeepChatwal (Himalaya Publishing House)

On-line resources to be used if available as reference material

Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry Vocational)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Major)	**US05MAICV02**	Title of the Course	**Plant Design and Mechanical Operations**
Total Credits of the Course	4	Hours per Week	4

Course Objectives	To make students familiar with: 1. The fundamentals of plant design and cost analysis in industrial processes. 2. Essential mechanical operations, including size reduction and separation techniques.

Course Content		
Unit	**Description**	**Weightage*(%)**
1.	Size Reduction and Separation Techniques: Principles of size reduction and size separation, Classification of crushers: Primary and secondary crushers, Fine grinding equipment and operational methodologies, Industrial screening techniques, Air classification methods, Size separation based on settling laws.	**25%**
2.	Filtration and Sedimentation: Filtration process and rate equations, Selection and application of filter media and filter aids, Industrial filtration equipment: Sand filters, plate & frame filters, leaf filters, rotary filters, and centrifugal filters, Sedimentation: Batch and continuous sedimentation processes, Use of thickeners and solid separation based on specific properties, Clarification equipment, cyclones, froth flotation, and jigging techniques.	**25%**
3.	Plant Design and Process Development: Principles of project development and evaluation, Key factors influencing plant design, Process design and selection of optimal industrial processes, Engineering flow diagrams, Selection of process equipment and materials, Chemical reactors and plant layout consideration.	**25%**
4.	Mixing and Surface Chemistry: Types and challenges in mixing operations, Mixing methodologies: Liquids with liquids, solids with solids, viscous mass mixing, Surface chemistry and interfacial phenomena, Adsorption, sols, gels, emulsions, and aerosols, Role of surfactants in industrial applications, Catalysis and its industrial significance.	**25%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per NEP – 2020)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per NEP – 2020)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Analyze and apply various separation techniques in industrial processes. Design and optimize separation units, such as distillation columns, using relevant computational methods
2.	Evaluate and select appropriate equipment and operating conditions for processes such as gas absorption, liquid extraction, leaching, drying, and evaporation. Understand and implement plant design principles, process flow diagrams, and selection of industrial materials and reactors.

Suggested References:

Sr. No.	References
1.	McCabe, W. L., Smith, J. C., & Harriott, P. - *Unit Operations of Chemical Engineering* (McGraw-Hill Education)
2.	Coulson, J. M., & Richardson, J. F. - *Chemical Engineering (Volume I & II)* (Elsevier/Butterworth-Heinemann)
3.	Badger, W. L., & Banchero, J. T. - *Introduction to Chemical Engineering* (McGraw-Hill)
4.	Gavhane, K. A. - *Unit Operations (Volume I & II)* (Nirali Prakashan)
5.	Perry, R. H., & Green, D. W. - *Perry's Chemical Engineers' Handbook* (McGraw-Hill Education)

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Major Practical)	**US05MAICV03**	Title of the Course	**Industrial Chemistry Vocational– Practical**
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	➢ Develop the skill for the preparation of Intermediates and Drugs using Unit Process and Quantitative Analysis of Intermediates and finished drugs. ➢ Enhance the skill about hands on training of various mechanical operations like size reduction, solid-solid separation, mixing, filtration etc., and calculation related to process parameters used in chemical industries.

Course Content

Part – I: - Preparation of Intermediates and Drugs based on Unit Process, Quantitative organic Analysis: Estimation and Analysis of Intermediates and finished drugs.
Part – II :- Study of characterization of Solid particles by Screen Analysis, Size reduction of solids using crushers & grinders and product analysis by differential analysis and by cumulative analysis, Study on efficiency of separation using cyclone separator, Study on filtration operation, Study on working of laboratory centrifuge, Study on solid-liquid mixing and solid mixing.

Teaching-Learning Methodology	Courses for B. Sc. Industrial Chemistry program is delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Practical Examination, Viva – Voice) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: This paper of practical will provide hands on exposure to students towards preparation and estimation of intermediates and drugs based on various unit process. More it will help to learn about hands on training of various mechanical operations like size reduction, solid-solid separation, mixing, filtration etc., Also they will learn the calculation related to process parameters used in chemical industries.

*****

Bachelor of Science – Undergraduate - (Industrial Chemistry Vocational)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor)	**US05MIICV01**	**Title of the Course**	**Petroleum and Petroleum Products**
Total Credits of the Course	**2**	**Hours per Week**	**2**

Course Objectives:	This paper will inculcate knowledge of Petroleum industry. The source of petroleum, process of rectification of crude and obtaining petroleum fractions and various fuels. Additionally, students will learn the manufacturing of various chemicals entities derived from petroleum source. Also, they will learn the analytical aspects of petroleum new material, fuels and products derived thereof.

Course Content		
Unit	Description	Weightage*(%)
1.	Introduction, Sources and deposits of world, Various Indian Petroleum industries, Purification (refining and rectification) process of petroleum, Cracking and Reforming process for the petroleum, various reaction occurs during cracking of petroleum fractions. Light petroleum products, their specifications and test methods, chemicals derived from C1, C2, C3 and C4-Fraction, Separation of components of Petroleum.	50%
2.	Manufacture of following compound form petroleum fractions: HCN, CS_2, Maleic anhydride, Caprolactum, Phthalic anhydride, Ethyl Benzene, Isopropylbenzene, Butadiene, Vinyl acetate, Acetaldehyde, Ethanol, Ethylene oxide, Phenol, Propionaldehyde, Benzene sulphonic acid.	50%

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	This paper will inculcate knowledge of petroleum industry.
2.	The students will study the sources of petroleum products, separation and purification, types of petroleum products and the chemistry of petroleum process.
3.	Also, they will learn about types of products obtained from petroleum fractions.

Suggested References:	
Sr. No.	References
1.	Modern petroleum refining processes vth addition., B.K. Bhaskara
2.	A text on Petrochemicals by Bhaskar Rao (Khanna Publishers-New Delhi)
3.	Modern Petroleum Refining process By Bhaskar Rao (Oxford & IBH Publishing Co, Pvt.Ltd.-New Delhi).
4.	Advanced Petrochemicals By Dr. G.N. Sarkar (Khanna Publishers).
5.	Advanced Petroleum Refining By Dr. G.N. Sarkar (Khanna Publishers).
6.	Chemicals from Petroleum by A.L. Waddam (ELBS edition, London).
7.	Shreve's Chemical Process Industries By Austin (Mac Grow-Hill Publiction, New Delhi).
8.	Riegel's Hand Book of Industrial Chemistry by James A Kent (CBS Publishers & Distributors-New Delhi).

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)
B. Sc. (UG) Semester – V(Effective from JUNE 2025)

Course Code (Minor)	**US05MIICV02**	**Title of the Course**	**Petroleum and Petroleum Products – Practical**
Total Credits of the Course	**02**	**Hours per Week**	**04**

Course Objectives:	This paper will Develop the skill of students towards various petroleum products (as per the ASTM testing Procedure). Moreover, it will help to help to develop the skill towards preparation, purification and analysis of various inorganic heavy and fine chemicals.

Course Content
Testing of Petroleum and Petroleum products according to ASTM for: Kinematic viscosity by Redwood viscometer and Say bolt Viscometer, Open cup Flash & Fire point determination, Distillation characteristics, Cloud & Pour Point determination, Aniline Point and Mixed Aniline Point, Carbon Residue by Ram's Bottle and calradon's method, % moisture determination Dean & Stark method, consistency of wax and grease determination by cone and needle penetration method and congealing point determination.

Teaching-Learning Methodology	Courses for B. Sc. Industrial Chemistry program are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Practical Examination, Viva – Voce) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to Acquire practical knowledge of basic petroleum laboratory tools which are used in petroleum industry, purification and preparation ofinorganic heavy and finechemicals for the subject of industrial chemistry.

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor)	**US05MIICV03**	Title of the Course	**Chemical Process Technology**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Understand the Manufacture and Properties of Nitrogenous Products. 2. Explore Electrothermal Industries, Gain Insight into Electrochemical Industries.

Course Content		
Unit	Description	Weightage*(%)
1.	Nitrogenous Products: Manufacture and study of properties of synthetic nitrogen products and miscellaneous inorganic chemicals such as ammonia and various types of nitrogenous fertilizers such as urea, ammonium sulphate, ammonium nitrate, calcium ammonium nitrate.	**50%**
2.	Electro thermal industries: Introduction, uses and economics of furnaces and their classification, manufacture of silicon carbide, calcium carbide, boron carbide, boron nitride, synthetic graphite, carbon electrode. Electro-chemical Industries: Magnesium anhydrous, $MgCl_2$, MgO, hydrogen peroxide, potassium permanganate, hydroxyl amine.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Demonstrate knowledge of the synthesis, properties, and industrial applications of synthetic nitrogen products, including ammonia, urea, ammonium sulfate, ammonium nitrate, and calcium ammonium nitrate.
2.	Understand the fundamentals of electrothermal processes, including the operation, uses, and economics of industrial furnaces.

Suggested References:	
Sr. No.	References
1.	“Industrial Chemistry” by B. K. Sharma.
2.	“Shreve’s Chemical Process Industries” by G. T. Austin
3.	"Chemistry and Technology of Fertilizers" by Vincent Sauchelli
4.	"Handbook of Industrial Furnaces and Kilns" by Charles A. Schacht
5.	"Electrochemical Engineering" by Thomas F. Fuller and John N. Harb

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor Practical)	**US05MIICV04**	Title of the Course	**Chemical Process Technology – Practical**
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	This paper will Develop the skill of students towards preparation of fine chemicals, purification of the product and analysis of various inorganic heavy and fine chemicals.

Course Content
Preparation, purification and estimation of fine chemicals such as Tetraamine amine copper (II) sulphate, Tetra thiourea copper (I) sulfate, Sodium thiosulfate, Hexa-thiourea Lead Nitrate, Chrome Red, Magnesium Hydroxide, Magnesium Carbonate, Magnesium Trisilicate, Magnesium Stearate, Zinc Stearate etc. Preparation of various industrial metal supported catalyst, Extraction and purification of industrial solvent, Physical and performance parameter of coating.

Teaching-Learning Methodology	Courses for B. Sc. Industrial Chemistry program are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Practical Examination, Viva – Voce) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to Acquire practical knowledge of basic methods for purification and preparation of inorganic heavy and fine chemicals for the subject of industrial chemistry.

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor)	**US05MIICV05**	Title of the Course	**Business Organization & Management – I**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Understanding Business Ownership, Entrepreneurship Skills, Financial Acumen. 2. Marketing Insight: Decision-Making and Analysis: Practical Application

Course Content		
Unit	Description	Weightage*(%)
1.	Forms of legal ownership, Ideal form of an organization, Feature, Advantages and disadvantages of Sole proprietorship, Partnership, Co-operative. Joint Hindu Family Organization and Joint Stock Company. Entrepreneurship decision, Launching of a new enterprise, Principle of management.	**50%**
2.	Financial management (source of finance, working and fixed capital). Interest and Depreciation, Taxes and Insurance. Marketing management (core concepts of marketing), Pricing policy, Break Even Analysis, Profitability criteria and selection of alternatives.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	The course will guide students through the critical decisions involved in entrepreneurship and launching new enterprises, including the application of fundamental management principles to establish and grow a successful business.
2.	Financial management topics will cover sources of finance, the management of working and fixed capital, and essential concepts such as interest, depreciation, taxes, and insurance, providing students with the tools needed to manage the financial health of an organization.

Suggested References:

Sr. No.	References
1.	"Business Organization and Management" by C.B. Gupta
2.	"Business Organization and Management" by M.C. Shukla
3.	"Entrepreneurship: Theory, Process, Practice" by Donald F. Kuratko
4.	"Entrepreneurship Development and Small Business Enterprises" by Poornima M. Charantimath
5.	"Principles of Management" by T.Ramasamy
6.	"Financial Management: Theory and Practice" by Prasanna Chandra
7.	"Marketing Management" by Philip Kotler, Kevin Lane Keller
8.	"Cost Accounting: A Managerial Emphasis" by Charles T. Horngren, Srikant M. Datar, Madhav V. Rajan

On-line resources to be used if available as reference material

Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor Practical)	**US05MIICV06**	Title of the Course	**Business Organization & Management – I – Project work**
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	This course aims to develop students' leadership and management skills in industrial settings, with a particular focus on the chemical industry. It enhances their understanding of business organization, financial planning, and industrial operations.

Course Content
Book Review Report Writing: Preparation, submission, and presentation of a book review related to business management or industrial operations. Case Study Analysis: Conducting a case study on a selected management area within the chemical industry, preferably based on an industrial visit. Project Work: Students will undertake projects on various topics related to industrial management, including, Forms of Legal Ownership, Financial Management, Marketing Management, Project Cost Estimation, Plant Location & Layout, Inventory Management.

Teaching-Learning Methodology	Courses for B. Sc. Industrial Chemistry program is delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Practical Examination, Viva – Voce) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Upon completion of this course, students will be able to:

- Develop a fundamental understanding of business organization and management principles.
- Gain hands-on experience with chemical industry management practices.
- Acquire knowledge of essential financial, marketing, and operational strategies in industrial settings.
- Apply theoretical concepts to real-world industrial scenarios through case studies and project work.

Suggested References:	
Sr. No.	References
1.	Koontz, H., & Weihrich, H. – *Essentials of Management: An International Perspective*
2.	Robbins, S. P., Coulter, M. – *Management*
3.	Hill, C. W. L., & Jones, G. R. – *Strategic Management: Theory*
4.	Kotler, P., Keller, K. L. – *Marketing Management*
5.	Kapoor, N. D. – *Elements of Business Law*
6.	Pandey, I. M. – *Financial Management*
7.	Bose, D. C. – *Inventory Management*
8.	Chary, S. N. – *Production and Operations Management*

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**
B. Sc. (UG) Semester - V

Course Code	**US05MIICV07**	Title of the Course	**FUNDAMENTALS OF PHYSICAL CHEMISTRY**
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	To make students familiar about: 1. Physical Chemistry concept like colloidal states and phase equillibria. 2. Understanding of significance of phase rule and colloidal states.

Course Content		
Unit	Description	Weightage* (%)
1.	**PHOTOCHEMISTRY:** Introduction, Types of chemical reactions, Difference between Dark and Photochemical reaction, Absorption of light, Laws of photochemistry, Quantum yield (or) Quantum efficiency, Deviation in the law of photochemical equivalence, Reasons of high and low quantum yield, Factors affecting quantum yield, Luminescence, Fluroescence and Phosphorescence, Numerical	**50%**
2.	**COLLOIDAL STATE:** Types of Colloidal system, Classifications of Colloids, Lyophobic and Lyophilic Sols, Size range, Preparation and Properties of colloids solution, Dialysis, Electro dialysis, Ultra filtration, Electrical Double Layer, Electrophoresis, Electro osmosis, Importance and Applications of Colloids, Numerical.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (Power Point presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50
2.	Semester End Examination [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn about basic concepts of colloidal states and phase equillibria.
2.	Know the basics to enable student in further studies and prepare for role in industries.

Suggested References Books:	
Sr. No.	References Books:
1.	Advanced Physical Chemistry by Gurdeep Raj.
2.	Text book of physical chemistry by Samuel Glasstone.
3.	Principles of Physical Chemistry by Puri, Sharma and Pathania. 38th Edition.
4.	Essential of physical chemistry by Bahl, Bahl and Tuli. 25th edition.
5.	Physical Chemistry by G. M. Barrow, 5th ed.
6.	Textbook of physical chemistry by P.L. Soni, O.P. Dharmarha, U. N. Dash
7.	University chemistry by Bruce H Mahan
8.	Principles of Physical chemistry, S H Marron, Karl F prutton
9.	Physical Chemistry, Ira Levine

10.	Physical Chemistry, Atkins
11.	Principles of polymers Science by P. Bahadur and N. V. Sastry (2nd Edition)
12.	Polymer Science by V. R. Gowariker, N. V. Vashwanathan and Jaydev Shreedhar.

On-line resources to be used if available as reference material
On-line Resources: Google books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**
B. Sc. (UG) Semester - V

Course Code	**US05MIICV08**	Title of the Course	**FUNDAMENTALS OF INORGANIC CHEMISTRY**
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	To make students familiar about: 1. Inorganic Chemistry as a subject. 2. Advanced topics of Inorganic chemistry. 3. Understanding of chemistry of organo metallic compounds and principles of metallurgy.

Course Content		
Unit	Description	Weightage* (%)
1.	**(A) ORGANO METALLIC CHEMISTRY:** Introduction, General methods of preparations, General properties, Organo metallic compounds of alkali metals, Organo metallic compounds of beryllium, Organo metallic compounds of magnesium, Organo metallic compounds of aluminium, Metal olefin (alkenes) complexes **(B) CYCLOPENTADIENYL COMPLEXES:** Preparation of metallocenes and their derivatives, Some properties of ferrocene molecule, Structure and bonding in ferrocene molecule, Ionic cyclopentadienyl compounds.	**50%**
2.	**PRINCIPLES OF METALLURGY AND CHEMISTRY OF Pb, Fe, & Cu:** Metals, Occurrence of metals, Mineral wealth of India, Metallurgy, Concentration and ore, Calcinations and roasting, Standard electrode potentials and metallurgy, Thermodynamics of metallurgy, Reducing behaviour of carbon, Reduction of mineral to metal, Refining of metals, Physical methods of refining, Chemical methods of refining, Types of furnaces used, Pb: occurrence & extraction, properties & uses of lead, white lead, Fe: occurrence and commercial forms of ion, manufacture of cast iron & steel, Cu: occurrence & extraction electrolytic refining of copper, properties and uses of copper.	**50%**

Teaching-	Conventional method (classroom blackboard teaching), ICT.

Learning Methodology	Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (Power Point presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation: Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50
2.	Semester End Examination [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn about basic concepts of organometallic compounds and metallurgy.
2.	Know the basics to enable student in further studies and prepare for role in industries.

Suggested References:	
Sr. No.	References
1.	Textbook of Inorganic Chemistry -20thedition, Chapter-13 By P. L. Soni & Mohan Katyal
2.	Advanced Inorganic Chemistry Volume II By Satya Prakash, G. D. Tuli, S. K. Basu, R. D. Madan
3.	CONCISE INORGANICCHEMISTRY : 5TH EDITION BY: J.D.LEE
4.	Basic Inorganic Chemistry- 3rd Edition By F.Albert Cotton, Geoffery Wilkinson & Paul L. Gaus

On-line resources to be used if available as reference material
On-line Resources: Google books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**
B. Sc. (UG) Semester - V

Course Code	**US05MIICV09**	Title of the Course	**FUNDAMENTALS OF CHEMISTRY PRACTICAL**
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	To make students familiar about: 1. Redox and acid-base estimations. 3. Practical aspects of chemistry 4. Basic concepts related to volumetric analysis. 5. Hands on training of laboratory practices.

Practical	Description
Practical	Volumetric analysis : Neutralization Titrations : (For the following exercise student has to prepare solution of titrant) (i) Standardization of NaOH using Succinic acid. (ii) Standardization of HCl using NaOH solution. (iii) Titration of Oxalic Acid → NaOH (iv) Titration of Succinic acid → KOH (v) Titration of Oxalic Acid → KOH TITRIMETRIC ANALYSIS (REDOX TITRATION) (vi) Titration of $KMnO_4$ → $FeSO_4(NH4)_2.SO_4$ .6 H_2O (vii) Titration of $K_2Cr_2O_7$ → $FeSO_4$ .7H_2O using internal indicator diphenylamine sulphate. (viii) Titration of $KMnO_4$ → Oxalic acid (ix) Titration of $KMnO_4$ → $FeSO_4.7H_2O$

Teaching-Learning Methodology	Hands on training to Practical Courses are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation: Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50
2.	Semester End Examination [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn about hands on training of Volumetric analysis.
2.	Improve practical skills of students.

Suggested References Books:	
Sr. No.	References Books
1.	Mendham, J., Denney, R. C., Barnes, J. D., Thomas, M. J. K., Vogel's textbook of quantitative chemical analysis, 6th Edition.
2.	Pandey, O. P., Bajpai, D. N., Giri, S., Practical Chemistry.
3.	Ghoshal, Mahapatra, Nad , An Advanced course in Practical Chemistry.

On-line resources to be used if available as reference material
On-line Resources: Google books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code	**US05SEICV01**	Title of the Course	**Industrial Safety & Hygiene**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. The basic knowledge of various types of safety required in chemical industries. 2. The knowledge of process that produces Hazardous chemicals & its Control, safety during transportation of chemicals, Inspections of chemical factories etc.

Course Content		
Unit	Description	Weightage*(%)
1.	Safety in chemical industries: Place of chemical industries in society, Statutory provisions, Types of chemical hazards & its control, General safety precautions.	**50%**
2.	Occupational Health Industrial Hygiene & Occupational Health, Occupational Health Hazard, Adverse Health Effect & its Control, Types and limits of radiation, Dangerous properties of chemicals and their health effect, Routes of entry & its toxic effects, Evaluation of Health Hazards, Sampling analysis in gas.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to

1.	Understand the places of chemical industries, statutory provisions of chemical industries, different types of chemical hazards & its control & the safety precautions.
2.	To acquire the basic knowledge of process Hazard & its Control, safety during transportation of chemicals, Inspections of chemical factories, etc.

Suggested References:	
Sr. No.	References
1.	Fundamental of Industrial safety & Health-volume-1 by Dr. K.S. Mistry.
2.	Fundamental of Industrial safety & Health-volume-2 by Dr. K.S. Mistry.

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code	**US05SEICV02**	Title of the Course	**Industrial Hazards & Management**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: The basic knowledge of various types of hazardous chemical in industries, types of tests, certificate & records. Moreover, students will gain the knowledge of management of chemical industries, safety & its responsibilities of employs, safety organizations, safety management education & training.

Course Content		
Unit	Description	Weightage*(%)
1.	Hazards & Control: Process of Hazard & its Control, Utility of Hazards & its control, Safety transportation of chemicals, checklist of routine inspections of chemical factories, Types of tests, certificate & records, permits for vessel entry.	**50%**
2.	Safety management: Concept of management, element of management, principle of management, safety & its responsibilities, safety organizations, department & programme, safety education & training.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	This paper will inculcate knowledge of Hazard & its Control, Uses of Hazards & its control, transportation of chemicals, routine inspections of chemical factories, Types of tests, certificate & records for documentation, etc.
2.	Moreover, students will gain the knowledge for the management chemical industries, various element of management, role of safety manager, safety education & training, etc.

Suggested References:	
Sr. No.	References
1.	Fundamental of Industrial safety & Health-volume-1 by Dr. K.S. Mistry.
2.	Fundamental of Industrial safety & Health-volume-2 by Dr. K.S. Mistry.

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code	**US05SEICV03**	Title of the Course	**Chemical Engineering Drawing**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Understanding the standard symbols and conventions used in chemical engineering equipment drawings. Developing proficiency in creating and interpreting block flow diagrams and process flow diagrams. 2. Learning the fundamentals of mounting and fitting parts in chemical processing equipment.

Course Content

Unit	Description	Weightage*(%)
1.	Chemical Engineering Equipment Drawing: Standard symbols and conventions used in chemical engineering, Representation of various equipment used in chemical processes, Standardized codes and symbols for process equipment, sketching of essential components such as: Valves (gate, globe, ball, and butterfly valves), Pipe fittings (elbows, tees, reducers, unions, and flanges), Joints (threaded, welded, flanged, and expansion joints).	**50%**
2.	Diagrams for Chemical Engineering: Freehand sketching of equipment used in unit operations, Preparation and interpretation of block flow diagrams (BFDs) and process flow diagrams (PFDs), Usage of appropriate symbols for representing industrial processes, Integration of equipment symbols into process diagrams.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Apply standard engineering symbols and conventions to represent chemical process equipment.
2.	Develop process flow diagrams and block flow diagrams for chemical plants.
3.	Demonstrate proficiency in sketching fundamental components used in industrial chemical engineering applications.
4.	Interpret engineering diagrams effectively for industrial applications.

Suggested References:	
Sr. No.	References
1.	Bhatt, N. D., & Panchal, V. M. - "Machine Drawing" (Latest Edition, Charotar Publishing House)
2.	Gopala Rao, M. - "Manufacturing Technology" (McGraw Hill Education, Latest Edition)
3.	Austin, G. T. - "Shreve's Chemical Process Industries" (McGraw Hill, Latest Edition)
4.	Ludwig, E. E. - "Applied Process Design for Chemical and Petrochemical Plants" (Gulf Professional Publishing, Latest Edition)
5.	Perry, R. H., & Green, D. W. - "Perry's Chemical Engineers' Handbook" (McGraw Hill, Latest Edition)

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) (Industrial Chemistry Vocational)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Major)	**US05MAICV01**	Title of the Course	**Organic Chemistry**
Total Credits of the Course	4	Hours per Week	4

Course Objectives	To make students familiar with: 1. Heterocyclic Chemistry and polynuclear hydrocarbon. 2. Various name reaction and reagents utilized for chemical reactions in the industries. 3. The basics of spectroscopy and its application in organic chemical analysis.

Course Content		
Unit	**Description**	**Weightage*(%)**
1.	**Heterocyclic Chemistry**: Nomenclature of heterocyclic systems (Five and Six membered only), Five membered heterocycles- structure, source and electrophilic substitution reaction in Pyrrole, Thiophene and furan. Six membered heterocyclic compounds: structure and source of pyridine compounds, nucleophilic and electrophilic substitution reaction in pyridine, basicity of pyridine, reduction of pyridine. Fused ring heterocycles- Skraup synthesis of Quinoline, Bischler-Nspierlaski synthesis of isoquinoline, Fischer indolesynthesis.	**25%**
2.	**Polynuclear hydrocarbon**: Introduction, Nomenclature, Structure, preparation and reaction of Naphthalene, anthracene and Phenanthrene.	**25%**
3.	**Some Reagents Of Synthetic Importance**: Aluminium isopropoxide, Diazomethane, N-Bromosuccinimide, Lead tetra acetate, Osmium tetraoxide, Selenium dioxide, LiAlH4 and NaBH4. **Reaction Mechanism**:, Hoffmann- Loffler Reaction, Baeyer Villiger Oxidation, Hunsdiecker Reaction, Favorskii Rearrangement, Benzoin Condensation ,**Concept of rearrangement** - Beckman Rearrangement, Benzilic acid Rearrangement and Pinacol-Pinacolone rearrangement.	**25%**
4.	**Ultraviolet (UV) and Visible Spectroscopy**: An Introduction, electronic transitional definition of some terms and designation of UV absorption bands. **Infrared Spectroscopy**: An introduction, Instrumentations, Applications of IR spectroscopy, Interpretation of IR spectra- characterization of functional groups and structural diagnosis. **NMR Spectroscopy**: PMR spectroscopy, shielding and deshielding , chemical shift, spin-spin splitting and coupling constant, area of signal, interpretation of PMR spectra of various simple organic molecules, Problems pertaining to the structure elucidation of organic compounds using UV, IR, Mass and PMRspectroscopy.	**25%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry Vocational programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per NEP – 2020)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per NEP – 2020)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to

1.	Students will learn Heterocyclic Chemistry and polynuclear hydrocarbon.
2.	Learn about various name reaction and reagents utilized for chemical reactions having direct applicability in the industries.
3.	Students will get exposed to the basics of spectroscopy and its application in organic chemical analysis.

Suggested References:

Sr. No.	References
1.	Organic Chemistry by Robert T. Morrison and Robert T. Boyd (VIth Edition, Prentice Hall of India Pvt. Ltd. NewDelhi)
2.	Organic Chemistry by R. K. Bansal (Tata McGraw – Hill Publishing Co. Ltd. New Delhi)
3.	Organic Chemistry by M. K. Jain and S. C. Jain (ShobanLAlNagin Chand & Co. Educational Publishers,Jalandhar).
4.	Spectroscopy of Organic Compounds by P. S. Kalsi (New Age International Publishers)
5.	Spectroscopy (Atomic & Molecular) by GurdeepChatwal (Himalaya Publishing House)

On-line resources to be used if available as reference material

Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry Vocational)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Major)	**US05MAICV02**	Title of the Course	**Plant Design and Mechanical Operations**
Total Credits of the Course	4	Hours per Week	4

Course Objectives	To make students familiar with: 1. The fundamentals of plant design and cost analysis in industrial processes. 2. Essential mechanical operations, including size reduction and separation techniques.

Course Content		
Unit	**Description**	**Weightage*(%)**
1.	Size Reduction and Separation Techniques: Principles of size reduction and size separation, Classification of crushers: Primary and secondary crushers, Fine grinding equipment and operational methodologies, Industrial screening techniques, Air classification methods, Size separation based on settling laws.	**25%**
2.	Filtration and Sedimentation: Filtration process and rate equations, Selection and application of filter media and filter aids, Industrial filtration equipment: Sand filters, plate & frame filters, leaf filters, rotary filters, and centrifugal filters, Sedimentation: Batch and continuous sedimentation processes, Use of thickeners and solid separation based on specific properties, Clarification equipment, cyclones, froth flotation, and jigging techniques.	**25%**
3.	Plant Design and Process Development: Principles of project development and evaluation, Key factors influencing plant design, Process design and selection of optimal industrial processes, Engineering flow diagrams, Selection of process equipment and materials, Chemical reactors and plant layout consideration.	**25%**
4.	Mixing and Surface Chemistry: Types and challenges in mixing operations, Mixing methodologies: Liquids with liquids, solids with solids, viscous mass mixing, Surface chemistry and interfacial phenomena, Adsorption, sols, gels, emulsions, and aerosols, Role of surfactants in industrial applications, Catalysis and its industrial significance.	**25%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per NEP – 2020)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per NEP – 2020)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Analyze and apply various separation techniques in industrial processes. Design and optimize separation units, such as distillation columns, using relevant computational methods
2.	Evaluate and select appropriate equipment and operating conditions for processes such as gas absorption, liquid extraction, leaching, drying, and evaporation. Understand and implement plant design principles, process flow diagrams, and selection of industrial materials and reactors.

Suggested References:

Sr. No.	References
1.	McCabe, W. L., Smith, J. C., & Harriott, P. - *Unit Operations of Chemical Engineering* (McGraw-Hill Education)
2.	Coulson, J. M., & Richardson, J. F. - *Chemical Engineering (Volume I & II)* (Elsevier/Butterworth-Heinemann)
3.	Badger, W. L., & Banchero, J. T. - *Introduction to Chemical Engineering* (McGraw-Hill)
4.	Gavhane, K. A. - *Unit Operations (Volume I & II)* (Nirali Prakashan)
5.	Perry, R. H., & Green, D. W. - *Perry's Chemical Engineers' Handbook* (McGraw-Hill Education)

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Major Practical)	**US05MAICV03**	Title of the Course	**Industrial Chemistry Vocational– Practical**
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	➢ Develop the skill for the preparation of Intermediates and Drugs using Unit Process and Quantitative Analysis of Intermediates and finished drugs. ➢ Enhance the skill about hands on training of various mechanical operations like size reduction, solid-solid separation, mixing, filtration etc., and calculation related to process parameters used in chemical industries.

Course Content

Part – I: - Preparation of Intermediates and Drugs based on Unit Process, Quantitative organic Analysis: Estimation and Analysis of Intermediates and finished drugs.
Part – II :- Study of characterization of Solid particles by Screen Analysis, Size reduction of solids using crushers & grinders and product analysis by differential analysis and by cumulative analysis, Study on efficiency of separation using cyclone separator, Study on filtration operation, Study on working of laboratory centrifuge, Study on solid-liquid mixing and solid mixing.

Teaching-Learning Methodology	Courses for B. Sc. Industrial Chemistry program is delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Practical Examination, Viva – Voice) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: This paper of practical will provide hands on exposure to students towards preparation and estimation of intermediates and drugs based on various unit process. More it will help to learn about hands on training of various mechanical operations like size reduction, solid-solid separation, mixing, filtration etc., Also they will learn the calculation related to process parameters used in chemical industries.

*****

Bachelor of Science – Undergraduate - (Industrial Chemistry Vocational)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor)	**US05MIICV01**	**Title of the Course**	**Petroleum and Petroleum Products**
Total Credits of the Course	**2**	**Hours per Week**	**2**

Course Objectives:	This paper will inculcate knowledge of Petroleum industry. The source of petroleum, process of rectification of crude and obtaining petroleum fractions and various fuels. Additionally, students will learn the manufacturing of various chemicals entities derived from petroleum source. Also, they will learn the analytical aspects of petroleum new material, fuels and products derived thereof.

Course Content		
Unit	Description	Weightage*(%)
1.	Introduction, Sources and deposits of world, Various Indian Petroleum industries, Purification (refining and rectification) process of petroleum, Cracking and Reforming process for the petroleum, various reaction occurs during cracking of petroleum fractions. Light petroleum products, their specifications and test methods, chemicals derived from C1, C2, C3 and C4-Fraction, Separation of components of Petroleum.	50%
2.	Manufacture of following compound form petroleum fractions: HCN, CS_2, Maleic anhydride, Caprolactum, Phthalic anhydride, Ethyl Benzene, Isopropylbenzene, Butadiene, Vinyl acetate, Acetaldehyde, Ethanol, Ethylene oxide, Phenol, Propionaldehyde, Benzene sulphonic acid.	50%

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	This paper will inculcate knowledge of petroleum industry.
2.	The students will study the sources of petroleum products, separation and purification, types of petroleum products and the chemistry of petroleum process.
3.	Also, they will learn about types of products obtained from petroleum fractions.

Suggested References:	
Sr. No.	References
1.	Modern petroleum refining processes vth addition., B.K. Bhaskara
2.	A text on Petrochemicals by Bhaskar Rao (Khanna Publishers-New Delhi)
3.	Modern Petroleum Refining process By Bhaskar Rao (Oxford & IBH Publishing Co, Pvt.Ltd.-New Delhi).
4.	Advanced Petrochemicals By Dr. G.N. Sarkar (Khanna Publishers).
5.	Advanced Petroleum Refining By Dr. G.N. Sarkar (Khanna Publishers).
6.	Chemicals from Petroleum by A.L. Waddam (ELBS edition, London).
7.	Shreve's Chemical Process Industries By Austin (Mac Grow-Hill Publiction, New Delhi).
8.	Riegel's Hand Book of Industrial Chemistry by James A Kent (CBS Publishers & Distributors-New Delhi).

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)
B. Sc. (UG) Semester – V(Effective from JUNE 2025)

Course Code (Minor)	**US05MIICV02**	**Title of the Course**	**Petroleum and Petroleum Products – Practical**
Total Credits of the Course	**02**	**Hours per Week**	**04**

Course Objectives:	This paper will Develop the skill of students towards various petroleum products (as per the ASTM testing Procedure). Moreover, it will help to help to develop the skill towards preparation, purification and analysis of various inorganic heavy and fine chemicals.

Course Content
Testing of Petroleum and Petroleum products according to ASTM for: Kinematic viscosity by Redwood viscometer and Say bolt Viscometer, Open cup Flash & Fire point determination, Distillation characteristics, Cloud & Pour Point determination, Aniline Point and Mixed Aniline Point, Carbon Residue by Ram's Bottle and calradon's method, % moisture determination Dean & Stark method, consistency of wax and grease determination by cone and needle penetration method and congealing point determination.

Teaching-Learning Methodology	Courses for B. Sc. Industrial Chemistry program are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Practical Examination, Viva – Voce) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to Acquire practical knowledge of basic petroleum laboratory tools which are used in petroleum industry, purification and preparation ofinorganic heavy and finechemicals for the subject of industrial chemistry.

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor)	**US05MIICV03**	Title of the Course	**Chemical Process Technology**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Understand the Manufacture and Properties of Nitrogenous Products. 2. Explore Electrothermal Industries, Gain Insight into Electrochemical Industries.

Course Content		
Unit	Description	Weightage*(%)
1.	Nitrogenous Products: Manufacture and study of properties of synthetic nitrogen products and miscellaneous inorganic chemicals such as ammonia and various types of nitrogenous fertilizers such as urea, ammonium sulphate, ammonium nitrate, calcium ammonium nitrate.	**50%**
2.	Electro thermal industries: Introduction, uses and economics of furnaces and their classification, manufacture of silicon carbide, calcium carbide, boron carbide, boron nitride, synthetic graphite, carbon electrode. Electro-chemical Industries: Magnesium anhydrous, $MgCl_2$, MgO, hydrogen peroxide, potassium permanganate, hydroxyl amine.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Demonstrate knowledge of the synthesis, properties, and industrial applications of synthetic nitrogen products, including ammonia, urea, ammonium sulfate, ammonium nitrate, and calcium ammonium nitrate.
2.	Understand the fundamentals of electrothermal processes, including the operation, uses, and economics of industrial furnaces.

Suggested References:	
Sr. No.	References
1.	“Industrial Chemistry” by B. K. Sharma.
2.	“Shreve’s Chemical Process Industries” by G. T. Austin
3.	"Chemistry and Technology of Fertilizers" by Vincent Sauchelli
4.	"Handbook of Industrial Furnaces and Kilns" by Charles A. Schacht
5.	"Electrochemical Engineering" by Thomas F. Fuller and John N. Harb

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)
B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor Practical)	**US05MIICV04**	Title of the Course	**Chemical Process Technology – Practical**
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	This paper will Develop the skill of students towards preparation of fine chemicals, purification of the product and analysis of various inorganic heavy and fine chemicals.

Course Content
Preparation, purification and estimation of fine chemicals such as Tetraamine amine copper (II) sulphate, Tetra thiourea copper (I) sulfate, Sodium thiosulfate, Hexa-thiourea Lead Nitrate, Chrome Red, Magnesium Hydroxide, Magnesium Carbonate, Magnesium Trisilicate, Magnesium Stearate, Zinc Stearate etc. Preparation of various industrial metal supported catalyst, Extraction and purification of industrial solvent, Physical and performance parameter of coating.

Teaching-Learning Methodology	Courses for B. Sc. Industrial Chemistry program are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Practical Examination, Viva – Voce) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to Acquire practical knowledge of basic methods for purification and preparation of inorganic heavy and fine chemicals for the subject of industrial chemistry.

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor)	**US05MIICV05**	Title of the Course	**Business Organization & Management – I**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Understanding Business Ownership, Entrepreneurship Skills, Financial Acumen. 2. Marketing Insight: Decision-Making and Analysis: Practical Application

Course Content		
Unit	Description	Weightage*(%)
1.	Forms of legal ownership, Ideal form of an organization, Feature, Advantages and disadvantages of Sole proprietorship, Partnership, Co-operative. Joint Hindu Family Organization and Joint Stock Company. Entrepreneurship decision, Launching of a new enterprise, Principle of management.	**50%**
2.	Financial management (source of finance, working and fixed capital). Interest and Depreciation, Taxes and Insurance. Marketing management (core concepts of marketing), Pricing policy, Break Even Analysis, Profitability criteria and selection of alternatives.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	The course will guide students through the critical decisions involved in entrepreneurship and launching new enterprises, including the application of fundamental management principles to establish and grow a successful business.
2.	Financial management topics will cover sources of finance, the management of working and fixed capital, and essential concepts such as interest, depreciation, taxes, and insurance, providing students with the tools needed to manage the financial health of an organization.

Suggested References:

Sr. No.	References
1.	"Business Organization and Management" by C.B. Gupta
2.	"Business Organization and Management" by M.C. Shukla
3.	"Entrepreneurship: Theory, Process, Practice" by Donald F. Kuratko
4.	"Entrepreneurship Development and Small Business Enterprises" by Poornima M. Charantimath
5.	"Principles of Management" by T.Ramasamy
6.	"Financial Management: Theory and Practice" by Prasanna Chandra
7.	"Marketing Management" by Philip Kotler, Kevin Lane Keller
8.	"Cost Accounting: A Managerial Emphasis" by Charles T. Horngren, Srikant M. Datar, Madhav V. Rajan

On-line resources to be used if available as reference material

Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code (Minor Practical)	**US05MIICV06**	Title of the Course	**Business Organization & Management – I – Project work**
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	This course aims to develop students' leadership and management skills in industrial settings, with a particular focus on the chemical industry. It enhances their understanding of business organization, financial planning, and industrial operations.

Course Content
Book Review Report Writing: Preparation, submission, and presentation of a book review related to business management or industrial operations. Case Study Analysis: Conducting a case study on a selected management area within the chemical industry, preferably based on an industrial visit. Project Work: Students will undertake projects on various topics related to industrial management, including, Forms of Legal Ownership, Financial Management, Marketing Management, Project Cost Estimation, Plant Location & Layout, Inventory Management.

Teaching-Learning Methodology	Courses for B. Sc. Industrial Chemistry program is delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Practical Examination, Viva – Voce) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Upon completion of this course, students will be able to:

- Develop a fundamental understanding of business organization and management principles.
- Gain hands-on experience with chemical industry management practices.
- Acquire knowledge of essential financial, marketing, and operational strategies in industrial settings.
- Apply theoretical concepts to real-world industrial scenarios through case studies and project work.

Suggested References:	
Sr. No.	References
1.	Koontz, H., & Weihrich, H. – *Essentials of Management: An International Perspective*
2.	Robbins, S. P., Coulter, M. – *Management*
3.	Hill, C. W. L., & Jones, G. R. – *Strategic Management: Theory*
4.	Kotler, P., Keller, K. L. – *Marketing Management*
5.	Kapoor, N. D. – *Elements of Business Law*
6.	Pandey, I. M. – *Financial Management*
7.	Bose, D. C. – *Inventory Management*
8.	Chary, S. N. – *Production and Operations Management*

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**
B. Sc. (UG) Semester - V

Course Code	**US05MIICV07**	Title of the Course	**FUNDAMENTALS OF PHYSICAL CHEMISTRY**
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	To make students familiar about: 1. Physical Chemistry concept like colloidal states and phase equillibria. 2. Understanding of significance of phase rule and colloidal states.

Course Content		
Unit	Description	Weightage* (%)
1.	**PHOTOCHEMISTRY:** Introduction, Types of chemical reactions, Difference between Dark and Photochemical reaction, Absorption of light, Laws of photochemistry, Quantum yield (or) Quantum efficiency, Deviation in the law of photochemical equivalence, Reasons of high and low quantum yield, Factors affecting quantum yield, Luminescence, Fluroescence and Phosphorescence, Numerical	**50%**
2.	**COLLOIDAL STATE:** Types of Colloidal system, Classifications of Colloids, Lyophobic and Lyophilic Sols, Size range, Preparation and Properties of colloids solution, Dialysis, Electro dialysis, Ultra filtration, Electrical Double Layer, Electrophoresis, Electro osmosis, Importance and Applications of Colloids, Numerical.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (Power Point presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50
2.	Semester End Examination [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn about basic concepts of colloidal states and phase equillibria.
2.	Know the basics to enable student in further studies and prepare for role in industries.

Suggested References Books:	
Sr. No.	References Books:
1.	Advanced Physical Chemistry by Gurdeep Raj.
2.	Text book of physical chemistry by Samuel Glasstone.
3.	Principles of Physical Chemistry by Puri, Sharma and Pathania. 38th Edition.
4.	Essential of physical chemistry by Bahl, Bahl and Tuli. 25th edition.
5.	Physical Chemistry by G. M. Barrow, 5th ed.
6.	Textbook of physical chemistry by P.L. Soni, O.P. Dharmarha, U. N. Dash
7.	University chemistry by Bruce H Mahan
8.	Principles of Physical chemistry, S H Marron, Karl F prutton
9.	Physical Chemistry, Ira Levine

10.	Physical Chemistry, Atkins
11.	Principles of polymers Science by P. Bahadur and N. V. Sastry (2nd Edition)
12.	Polymer Science by V. R. Gowariker, N. V. Vashwanathan and Jaydev Shreedhar.

On-line resources to be used if available as reference material
On-line Resources: Google books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**
B. Sc. (UG) Semester - V

Course Code	**US05MIICV08**	Title of the Course	**FUNDAMENTALS OF INORGANIC CHEMISTRY**
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	To make students familiar about: 1. Inorganic Chemistry as a subject. 2. Advanced topics of Inorganic chemistry. 3. Understanding of chemistry of organo metallic compounds and principles of metallurgy.

Course Content		
Unit	Description	Weightage* (%)
1.	**(A) ORGANO METALLIC CHEMISTRY:** Introduction, General methods of preparations, General properties, Organo metallic compounds of alkali metals, Organo metallic compounds of beryllium, Organo metallic compounds of magnesium, Organo metallic compounds of aluminium, Metal olefin (alkenes) complexes **(B) CYCLOPENTADIENYL COMPLEXES:** Preparation of metallocenes and their derivatives, Some properties of ferrocene molecule, Structure and bonding in ferrocene molecule, Ionic cyclopentadienyl compounds.	**50%**
2.	**PRINCIPLES OF METALLURGY AND CHEMISTRY OF Pb, Fe, & Cu:** Metals, Occurrence of metals, Mineral wealth of India, Metallurgy, Concentration and ore, Calcinations and roasting, Standard electrode potentials and metallurgy, Thermodynamics of metallurgy, Reducing behaviour of carbon, Reduction of mineral to metal, Refining of metals, Physical methods of refining, Chemical methods of refining, Types of furnaces used, Pb: occurrence & extraction, properties & uses of lead, white lead, Fe: occurrence and commercial forms of ion, manufacture of cast iron & steel, Cu: occurrence & extraction electrolytic refining of copper, properties and uses of copper.	**50%**

Teaching-	Conventional method (classroom blackboard teaching), ICT.

Learning Methodology	Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (Power Point presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation: Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50
2.	Semester End Examination [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn about basic concepts of organometallic compounds and metallurgy.
2.	Know the basics to enable student in further studies and prepare for role in industries.

Suggested References:	
Sr. No.	References
1.	Textbook of Inorganic Chemistry -20thedition, Chapter-13 By P. L. Soni & Mohan Katyal
2.	Advanced Inorganic Chemistry Volume II By Satya Prakash, G. D. Tuli, S. K. Basu, R. D. Madan
3.	CONCISE INORGANICCHEMISTRY : 5TH EDITION BY: J.D.LEE
4.	Basic Inorganic Chemistry- 3rd Edition By F.Albert Cotton, Geoffery Wilkinson & Paul L. Gaus

On-line resources to be used if available as reference material
On-line Resources: Google books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**
B. Sc. (UG) Semester - V

Course Code	**US05MIICV09**	Title of the Course	**FUNDAMENTALS OF CHEMISTRY PRACTICAL**
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	To make students familiar about: 1. Redox and acid-base estimations. 3. Practical aspects of chemistry 4. Basic concepts related to volumetric analysis. 5. Hands on training of laboratory practices.

Practical	Description
Practical	Volumetric analysis : Neutralization Titrations : (For the following exercise student has to prepare solution of titrant) (i) Standardization of NaOH using Succinic acid. (ii) Standardization of HCl using NaOH solution. (iii) Titration of Oxalic Acid → NaOH (iv) Titration of Succinic acid → KOH (v) Titration of Oxalic Acid → KOH TITRIMETRIC ANALYSIS (REDOX TITRATION) (vi) Titration of $KMnO_4$ → $FeSO_4(NH4)_2.SO_4$ .6 H_2O (vii) Titration of $K_2Cr_2O_7$ → $FeSO_4$ .7H_2O using internal indicator diphenylamine sulphate. (viii) Titration of $KMnO_4$ → Oxalic acid (ix) Titration of $KMnO_4$ → $FeSO_4.7H_2O$

Teaching-Learning Methodology	Hands on training to Practical Courses are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation: Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50
2.	Semester End Examination [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn about hands on training of Volumetric analysis.
2.	Improve practical skills of students.

Suggested References Books:	
Sr. No.	References Books
1.	Mendham, J., Denney, R. C., Barnes, J. D., Thomas, M. J. K., Vogel's textbook of quantitative chemical analysis, 6th Edition.
2.	Pandey, O. P., Bajpai, D. N., Giri, S., Practical Chemistry.
3.	Ghoshal, Mahapatra, Nad , An Advanced course in Practical Chemistry.

On-line resources to be used if available as reference material
On-line Resources: Google books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code	**US05SEICV01**	Title of the Course	**Industrial Safety & Hygiene**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. The basic knowledge of various types of safety required in chemical industries. 2. The knowledge of process that produces Hazardous chemicals & its Control, safety during transportation of chemicals, Inspections of chemical factories etc.

Course Content		
Unit	Description	Weightage*(%)
1.	Safety in chemical industries: Place of chemical industries in society, Statutory provisions, Types of chemical hazards & its control, General safety precautions.	**50%**
2.	Occupational Health Industrial Hygiene & Occupational Health, Occupational Health Hazard, Adverse Health Effect & its Control, Types and limits of radiation, Dangerous properties of chemicals and their health effect, Routes of entry & its toxic effects, Evaluation of Health Hazards, Sampling analysis in gas.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to

1.	Understand the places of chemical industries, statutory provisions of chemical industries, different types of chemical hazards & its control & the safety precautions.
2.	To acquire the basic knowledge of process Hazard & its Control, safety during transportation of chemicals, Inspections of chemical factories, etc.

Suggested References:	
Sr. No.	References
1.	Fundamental of Industrial safety & Health-volume-1 by Dr. K.S. Mistry.
2.	Fundamental of Industrial safety & Health-volume-2 by Dr. K.S. Mistry.

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

(Bachelor of Science) (Undergraduate) **(Industrial Chemistry-Vocational)**

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code	**US05SEICV02**	Title of the Course	**Industrial Hazards & Management**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: The basic knowledge of various types of hazardous chemical in industries, types of tests, certificate & records. Moreover, students will gain the knowledge of management of chemical industries, safety & its responsibilities of employs, safety organizations, safety management education & training.

Course Content		
Unit	Description	Weightage*(%)
1.	Hazards & Control: Process of Hazard & its Control, Utility of Hazards & its control, Safety transportation of chemicals, checklist of routine inspections of chemical factories, Types of tests, certificate & records, permits for vessel entry.	**50%**
2.	Safety management: Concept of management, element of management, principle of management, safety & its responsibilities, safety organizations, department & programme, safety education & training.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	This paper will inculcate knowledge of Hazard & its Control, Uses of Hazards & its control, transportation of chemicals, routine inspections of chemical factories, Types of tests, certificate & records for documentation, etc.
2.	Moreover, students will gain the knowledge for the management chemical industries, various element of management, role of safety manager, safety education & training, etc.

Suggested References:	
Sr. No.	References
1.	Fundamental of Industrial safety & Health-volume-1 by Dr. K.S. Mistry.
2.	Fundamental of Industrial safety & Health-volume-2 by Dr. K.S. Mistry.

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science) (Undergraduate) (Industrial Chemistry-Vocational)

B. Sc. (UG) Semester – V (Effective from JUNE 2025)

Course Code	**US05SEICV03**	Title of the Course	**Chemical Engineering Drawing**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Understanding the standard symbols and conventions used in chemical engineering equipment drawings. Developing proficiency in creating and interpreting block flow diagrams and process flow diagrams. 2. Learning the fundamentals of mounting and fitting parts in chemical processing equipment.

Course Content

Unit	Description	Weightage*(%)
1.	Chemical Engineering Equipment Drawing: Standard symbols and conventions used in chemical engineering, Representation of various equipment used in chemical processes, Standardized codes and symbols for process equipment, sketching of essential components such as: Valves (gate, globe, ball, and butterfly valves), Pipe fittings (elbows, tees, reducers, unions, and flanges), Joints (threaded, welded, flanged, and expansion joints).	**50%**
2.	Diagrams for Chemical Engineering: Freehand sketching of equipment used in unit operations, Preparation and interpretation of block flow diagrams (BFDs) and process flow diagrams (PFDs), Usage of appropriate symbols for representing industrial processes, Integration of equipment symbols into process diagrams.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered through classroom, and laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models).

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal (Written Examination, Practical Examination, Continuous Evaluation, Quizzes, Seminars, Assignments, Attendance) (As per NEP – 2020)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Apply standard engineering symbols and conventions to represent chemical process equipment.
2.	Develop process flow diagrams and block flow diagrams for chemical plants.
3.	Demonstrate proficiency in sketching fundamental components used in industrial chemical engineering applications.
4.	Interpret engineering diagrams effectively for industrial applications.

Suggested References:	
Sr. No.	References
1.	Bhatt, N. D., & Panchal, V. M. - "Machine Drawing" (Latest Edition, Charotar Publishing House)
2.	Gopala Rao, M. - "Manufacturing Technology" (McGraw Hill Education, Latest Edition)
3.	Austin, G. T. - "Shreve's Chemical Process Industries" (McGraw Hill, Latest Edition)
4.	Ludwig, E. E. - "Applied Process Design for Chemical and Petrochemical Plants" (Gulf Professional Publishing, Latest Edition)
5.	Perry, R. H., & Green, D. W. - "Perry's Chemical Engineers' Handbook" (McGraw Hill, Latest Edition)

On-line resources to be used if available as reference material
Online Resources: Google Books, INFLIBNET, Google Web

*****