



(Bachelor of Science)(Undergraduate)
B. Sc. (UG) Semester –IV

Course Code	US04CICH51	Title of the Course	Chemical Plant Utilities
Total Credits of the Course	4	Hours per Week	4
Course Objectives:	To make students familiar with: 1. Impurities and hardness of natural water 2. Basic concepts of compression equipment's, Industrial refrigerants, Carnot and other refrigeration cycles. 3. Basic concepts of combustion engines, corrosion.		

Course Content		
Unit	Description	Weightage* (%)
1.	Water- Impurities and hardness of natural water, Water for steam making and industrial processes, Boiler water treatments, Calculations on water treatments. Fuels-classification, advantages and disadvantages, Analysis of fuels, heating media	25%
2.	Compression equipment's, Reciprocating compressor, Work of single stage reciprocating compressor, Effect of clearance, Volumetric efficiency, Multistage compression, Refrigeration, COP & refrigerating effect, Industrial refrigerants, Carnot and other refrigeration cycles.	25%
3.	Internal combustion engines and external combustion engine, Steam power plant, its working, Otto engine and Diesel engine. Steam boilers – Their classification, Steam generation, Conditions of steam, Steam table.	25%
4.	Corrosion: Theories of corrosion, Corrosion reactions, Special corrosions, Factors affecting corrosion rate, Protection against the corrosion. Refractory: Classification, Properties and manufacture of important refractory, Their selection and failure.	25%

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programme 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).
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn about basic concepts of Impurities and hardness of natural water, compression equipment's, Industrial refrigerants, Carnot and refrigeration cycles, combustion engines, corrosion.
2.	Apply this knowledge in further studies of third year B.Sc. Industrial chemistry course.
Suggested References:	
Sr. No.	References Books
1.	Chemical Process Principles: (Part I), Haugen, Watson and Regatz (Asia Pub. House).
2.	Fuels and combustion, S. P. Sharma and Chandra Mohan Tata Mc Graw.
3.	Fuels and Combustion, Samir Sarkar, Orient Longniur Ltd.
4.	Chemistry of engineering materials by C.V. Agraval, Tara Publications.

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





(Bachelor of Science)(Undergraduate)
B. Sc. (UG) Semester –IV

Course Code	US04CICH52	Title of the Course	Analytical Chemistry
Total Credits of the Course	4	Hours per Week	4
Course Objectives:	To make students familiar with: 1. Basic concepts of Titrimetric Methods of Chemical Analysis and Redox Titrations. 2. Basic concepts of pH metry and Chromatography.		

Course Content		
Unit	Description	Weightage* (%)
1.	Titrimetric Methods of Chemical Analysis, General principle of titrimetry, Types of reactions in titrimetry, Standard solution, Basic requirements of titrimetry, Equivalence point and end point, Aqueous Acid Base Titrations. Concept of acid base titration, Titration curves, Acid- base indicators, Titration Feasibility and its applications. Non-aqueous Acid-base Titrations. Role and properties of solvents, Titrations in non-aqueous solvents.	25%
2.	Redox Titrations: Introduction, Redox systems, Redox potential, Nernst equation, Equilibrium constant, Titration curve & feasibility. Iodometric and iodimetric titrations. Complexometric Titrations - Introduction, Stability constant, Ways of detecting end point, Titration curves, Types of EDTA titrations. Precipitation Titrations - Introduction, Feasibility and end point detection, Indicators, Factors affecting solubility of precipitates. Gravimetric Methods of Analysis - Principle of gravimetry, Requirements of precipitates, Formation and properties of precipitates, Coagulation & peptization, Co-precipitation and occlusion, Washing, drying and ignition of precipitate, estimation of Ni metal as Ni(DMG) ₂ .	25%
3.	pH metry – Introduction, determination of pH & applications. Potentiometric titrations - Introduction, Types of titrations & Advantages of potentiometric titrations. Conductometric measurements - Introduction, Some important laws, Definition and relations, Effect of dilution, Applications of conductance measurements, Types of	25%





	titrations, Advantages and disadvantages.	
4.	Chromatography - Introduction, Classification and applications. Paper chromatography – Introduction, Experimental details for qualitative analysis. Thin layer chromatography – Introduction, Superiority of TLC over the other techniques, Experimental techniques, Scope & limitations. Column chromatography - Introduction, Experimental details, Theory of development, factors affecting column efficiency. GC & HPLC - Introduction, Instrumentation, Sampling methods, Experimental details and applications.	25%

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programme 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).
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn about basic concepts of Impurities and hardness of natural water, compression equipment's, Industrial refrigerants, Carnot and refrigeration cycles, combustion engines, corrosion.
2.	Apply this knowledge in further studies of third year B.Sc. Industrial chemistry course.
Suggested References:	
Sr.	References Books





No.	
1.	Instrumental methods of chemical analysis by Chatwal – Anand, Himalaya Publishing House.
2.	Instrumental methods of chemical analysis by B.K. Sharma, Krishna Publication Media (P) Ltd., Meerut.
3.	Analytical chemistry by Gray D. Christian, 4 th edition, Wiley & Sons, Inc.
4.	Instrumental methods of analysis by Willard Merritt, Dean Settle, CBS Publishers & Distributors, New Delhi.
5	Principles of instrumental analysis by Skoog, Holler, Nieman, Thomson Asia Pvt. Ltd., Singapore.
6	Basic concept of analytical chemistry by S.M. Khopkar, New Age International Publishers.
7	Instrumental methods of chemical analysis by Galen W. Ewing, McGraw – Hill Book Company.

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

On-line Resources: Google books, INFLIBNET, Google Web





(Bachelor of Science)(Undergraduate)
B. Sc. (UG) Semester – IV

Course Code	US04CICH53	Title of the Course	Practical
Total Credits of the Course	4	Hours per Week	8
Course Objectives:	To make students familiar with: 1. Practical aspects of Water analysis. 2. Hands on experience of inorganic substance by semimicro qualitative analysis, pH and conductometric titrations, application of Chromatographic techniques.		

Course Content	
Practical	Description
I	Water analysis: Determination of Suspended Solid, Dissolved Solid, Carbonates and Bicarbonates, Chloride, Total acidity of given sample, Total hardness, Sulphates, Temporary and Permanent determination of calcium and magnesium hardness using EDTA, ion exchange resins for water purification, Fuels: Proximate Analysis of Coal, Moisture content, Nitrogen content, Demonstration of boiler & steam, Testing methods for corrosion.
II.	Analysis of inorganic substance by semi micro qualitative analysis, Preparation of various solutions, its standardization for the estimation of metals and organic compounds. Experiments based on gravimetric, Complexometric, Iodometry & Iodimetry methods. Analysis of inorganic substance by semi micro qualitative analysis. pH and conductometric titrations. Experiments based on an application of Chromatographic techniques.

Teaching-Learning Methodology	Hands on training, Practical's. Courses for B. Sc. Industrial Chemistry programme are delivered through 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).
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Evaluation Pattern		
Sr.No.	Details of the Evaluation	Weightage





SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2022-2023

1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	---
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	--
3.	University Examination	100%

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

1.	Learn about separation and identification of inorganic mixture.
2.	Know about water analysis, pH and conductometric titrations. Experiments based on an application of Chromatographic techniques. This will improve practical skills of students.

Suggested References:

Sr. No.	References
1.	Vogel's Textbook of Quantitative Chemical Analysis, 5 th Edition By G. H. Jeffery, J. Basset, J. Mendham, R. C. Denney.

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

On-line Resources: Google books, INFLIBNET, Google Web





(Bachelor of Science)(Undergraduate)
B. Sc. (UG) Semester –IV

Course Code	US04SICH51	Title of the Course	Introduction to Green Chemistry
Total Credits of the Course	2	Hours per Week	2
Course Objectives:	To make students familiar with: 1. Basic of Green Chemistry and its principles. 2. Concepts of Green Catalyst and green techniques. 3. Introduction to application of Green Chemistry in day to day life..		

Course Content		
Unit	Description	Weightage* (%)
1.	Introduction to the concepts of Green Chemistry, Principles of Green Chemistry, Steps to Design Green synthesis, Choice of starting material, reagents, catalyst, solvents for green synthesis, Concept of Atom economy.	25%
2.	Study of Green Catalyst (Viz. Acidic, Basic, Polymer supported catalyst, Biocatalyst), Introduction, application Phase transfer catalyst, Crown ethers.	25%
3.	Introduction and Application to various green techniques of Green Synthesis viz. Electrochemical, Photochemical, Microwave, Ultrasound. Aqueous phase reaction and solid phase reaction.	25%
4.	Synthesis of: Adipic Acid, Catechol, Methyl Methacrylate, Urethane, Furfural from biomass, Ibuprofen, Paracetamol. Application of Green Chemistry in day to day life. Dry cleaning of clothes, versatile bleaching agent, Ionic liquids as versatile green solvent.	25%

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programme 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).
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Evaluation Pattern





SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2022-2023

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	--
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	--
3.	University Examination	100%

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

1.	Learn Concepts of Green Chemistry and its Applications in day to day life.
2.	Apply knowledge in further studies of third year B.Sc. Industrial chemistry course.

Suggested References:

Sr. No.	References Books
1.	Green Chemistry by V.K. Ahluwalia.
2.	Principles of Green Chemistry by V.K. Ahluwalia and M. Kidwai.

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

On-line Resources: Google books, INFLIBNET, Google Web

