(Bachelor of Science)(Undergraduate) (Industrial Chemistry Vocational)
B. Sc. (UG) Semester –III (Effective from JUNE 2022)

Course Code	**US03CICV51**	Title of the Course	**Chemical Plant Auxiliaries and Manufacturing**
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	To make students familiar with: 1. Basis of Water- Impurities and hardness of natural water. 2. Concepts of Compression process. 3. Basic concepts of Nitration process and oxidation process.

Course Content		
Unit	Description	Weightage* (%)
1.	Water- Impurities and hardness of natural water, Water for steam making and industrial processes, Boiler water treatments, Calculation on water treatment, Fuel - classification, Advantages and disadvantages, Analysis of fuels, Heating media, Air- Specification for industrial uses of air. Industrial applications of CO_2, O_2, N_2 and H_2.	**25%**
2.	Compression equipments, Reciprocating compressor, Work of single stage reciprocating compressor, Effect of clearance, Volumetric efficiency, Multistage compression, Refrigeration, COP & refrigerating effect, Industrial refrigerant, Carnot and other refrigeration cycles, Internal combustion engines and external combustion engines, Steam power plant, Its working and thermodynamic analysis, Otto engine and Diesel engine, Steam boilers - Their classification, Steam generation, Conditions of steam, Steam table.	**25%**
3.	Nitration - Introduction, Nitration agents, Continuous vs batch nitration, Benzene to nitrobenzene and m-dinitrobenzene, Chlorobenzene to ortho and para nitro - chlorobenzene, Acetanitide to p-nitroacetanilide, Amination - by reduction - Introduction, Methods of reduction, Metal and acid, Catalyst sulfide, electrolytic, Metal and alkali sulfites, Metal hydrides, Sodium metal, concentrated caustic oxidation, Reduction, Reduction commercial manufacturing of aniline, m-nitroaniline. Sulphonation - Introduction, sulphonating agents, Kinetics and mechanism of sulphonation reaction, Commercial	**25%**

	sulfonation of benzene.	
4.	Oxidation - Introduction, Types of oxidation reactions, Oxiding agents, Liquid phase oxidation, Vapor phase oxidation, Commercial manufacture of benzoic acid, Phthalic anhydride, Acetic acid. Halogenation- Introduction, kinetics of halogenation reactions, Reagents for halogenation, Commercial production process of Chlorobenzene & Monochloro acetic acid. Hydrogenation- Introduction kinetics, Catalysts for hydrogenation reactions, Hydrogenation of vegetable oil. Esterification- Introduction, Esterification of carboxylic acid derivatives, Commercial manufacture of ethyl acetate. Hydrolysis - Introduction, Hydrolysis agents & mechanism of hydrolysis.	**25%**

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

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 Compression, water analysis, Nitration and oxidation process.
2.	Apply knowledge in further studies of third year B.Sc. Industrial chemistry Vocational course.

Suggested References:	
Sr. No.	References Books
1.	Chemistry of Engineering Materials by C. V. Agrawal (Tara Publication).
2.	Introduction to Chemical Engineering Thermodynamics (IV edition) by J. M. Smith & Vanness, (McGraw-Hill Co.)
3	Chemistry in Engineering and Technology, (volume I & II) J C Kuriacose & J. Rajaral (Tata McGarw Hill).
4	Chemistry of Engineering Materials By Jain &Jain. (Dhanpairai Publishing Co.).
5	Shreve's Chemical Process Industries by George T. Austin (McGrow-Hill, Publication, New Delhi).
6	Unit process in Organic synthesis, P. H. Groggins, Mcgraw- Hill Book Co., New York.

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

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(Bachelor of Science)(Undergraduate) (Industrial Chemistry Vocational)
B. Sc. (UG) Semester –III (Effective from JUNE 2022)

Course Code	**US03CICV52**	Title of the Course	**Fundamentals of Organic Chemistry**
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	To make students familiar with: 1. Basis of Fundamental Aspects In Organic Chemistry. 2. Concepts of Phenols, Alcohols, Ethers and Epoxides. 3. Basic concepts of Aldehydes, Ketones, Carboxylic Acids And their derivatives.

Course Content		
Unit	Description	Weightage* (%)
1.	Fundamental Aspects In Organic Chemistry: Hybridization, Sigma and pi - bonds, Hydrogen bond, Inductive effect, Electronic effect, Resonance effect, Hyper-conjugation, Steric effect, Acid and bases, Definition, structure and stability of free-radical, Carbocation, Cabanion, and Benzyne, Energy profiles.	**25%**
2.	Phenols, Alcohols, Ethers and Epoxides: Phenols -Structure, Nomenclature, Preparation, Physical properties, Salts of phenol, Acidity of phenols, Reactions. Alcohols - Structure, Classification, Nomenclature, Preparation, Physical properties, reactions, Alcohols as acids and bases, Synthesis using alcohols, Formation of 1,2-diols, Analysis of 1,2-diols, Oxidation cleavage of polyhydroxy-alcohols. Ethers - Structure, Nomenclature, Preparation, Physical properties, Reactions, Cyclic ethers. Epoxides - Preparation and reactions.	**25%**
3.	Aldehydes, Ketones, Carboxylic Acids And their derivatives: Structure, Classification, Nomenclature, Preparation, Physical properties, Nucleophilic addition reactions, Base promoted halogenation of ketones, Acid catalyzed halogenation of ketones. Structure, Nomenclature, Preparation, Physical properties, Salts of carboxylic acids, Acidity of carboxylic acids, Effect of substituents on acidity, Reactions, reactions of acid chloride, Acid anhydrides,	**25%**

	Amides and esters. Preparation of malic acid and tartaric acid from maleic acid, preparation of citric acid from glycerol.	
4.	Amines And Diazonium Salts Amines-Structure, Nomenclature, Preparation, Hoffman rearrangement, Physical prope1iies, Salts of amines, Basicity of amines, Effect of substituents on basicity, reactions, Hoffman elimination, Analysis of amines, Phase transfer catalyst. Diazonium salts - Synthesis, reaction and characteristics.	**25%**

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

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 fundamental aspects In Organic Chemistry, Phenols, Alcohols, Ethers and Epoxides, Aldehydes, Ketones, Carboxylic acids and their derivatives, Amines And Diazonium Salts.
2.	Apply knowledge in further studies of third year B.Sc. Industrial chemistry Vocational course.

Suggested References:	
Sr. No.	References Books

1.	Organic Chemistry by M. K. Jain and S. C. Jain (Shoban LAl Nagin Chand & Co. Educational Publishers, Jalandhar).
2.	Organic Chemistry by Robert T. Morison and Robert T. Boyd (Vth Edition, Prentice Hall of India Pvt. Ltd. New Delhi).
3	Organic Chemistry by R. K. Bansal (Tata McGraw - Hill Publishing Co. Ltd. New Delhi).

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

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(Bachelor of Science)(Undergraduate) (Industrial Chemistry Vocational)
B. Sc. (UG) Semester – III (Effective from JUNE 2022)

Course Code	**US03CICV53**	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 preparation of solutions & its standardization. 2. Hands on experience of water analysis, binary organic mixture separation, identification and derivatives preparation.

Course Content	
Practical	Description
I	Water analysis - suspended solids, total dissolved solids, carbonate and bicarbonates, sulfate as $BaSO_4$, chlorine content, Ca & Mg, acidity and total hardness etc., Preparation and estimation of organic compounds based on various unit process.
II.	Organic Spotting of a binary mixture, separation, identification and derivatives preparation. Experiment based on lab skill enhancement for preparation of laboratory (Preparation and Standardization of laboratory solution).

Teaching-Learning Methodology	Hands on training of Practical's. Courses for B. Sc. Industrial Chemistry Vocational 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).

Evaluation Pattern		
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 about separation and identification of binary organic mixture and water analysis.
2.	Apply knowledge in further studies of third year B.Sc. Industrial chemistry Vocational course.

Suggested References:	
Sr. No.	References Books:
1.	Vogel's Textbook of Quantitative Chemical Analysis, 5thEdition 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

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