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

Course Code	**US03CICH51**	Title of the Course	**Chemical Process Principles & Engineering Materials**
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	To make students familiar with: 1. Basis of calculation related to density, material balance, units etc. 2. Concepts of Energy balance. 3. Basic concepts of material science, cement, glass, metals and alloys.

Course Content		
Unit	Description	Weightage* (%)
1.	Basis of calculation, Density & specific gravity, Units to express composition of systems, Ideal gas equation, Behavior of gaseous mixtures. Material Balance: Elementary concept of unit operations and unit processes, Concept of mass balance and types of mass balance problems, Strategies and Guidelines for mass balance calculation, Mass balance calculations for processes-without and with chemical reactions, Recycle operation and purge operation, Bypass operation.	**25%**
2.	Energy Balance: Concept of Energy balance, Forms of energy, Energy balance for batch and continuous processes, Heat capacity and specific heat, Combustion and Calorific value of fuels, Combustion calculations. Adsorption: Adsorbent and adsorbate, Chemisorptions and physical adsorption, Adsorption isotherms, Application of adsorption.	**25%**
3.	Material Sciences: Introductions of material sciences, Classification of engineering materials, Engineering requirements of materials, Plan for selection of materials. Ceramic industries: Raw materials, Manufacturing of White wares, Structural clay products.	**25%**
4.	Cement: Portland cement, Other cements, Setting and hardening of cement, Manufacture and uses of ordinary cement. Glass: Raw materials, Types of glasses, Manufacture and uses. Metals and Alloys: Need, preparation, Mechanical & chemical	**25%**

	properties, Applications, Composition of important metals and alloys-iron, copper, aluminium and their alloys.	

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).

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 basis of calculation related to density, material balance, units, Energy balance, material science, cement, glass, metals and alloys.
2.	Apply knowledge in further studies of third year B.Sc. Industrial chemistry course.

Suggested References:

Sr. No.	References
1.	Chemical Process Principles: (Part I), Haugen, Watson and Regatz (Asia Pub. House).
2.	Stoichiometry : B. L. Bhatt & Vora S. M. (Tata McGraw-Hill Publication).
3	Basic Principles & Calculation in Chemical Engineering, David M Himnelblan (Prentice Hall Inc.)

4	Chemical Process Calculation (Stoichiometry), K. A. Gavhane (Nirali Prakashan-Pune)
5	Chemistry of Engineering Materials by C. V. Agrawal (Tara Publication)
6	Introduction to Chemical Engineering Thermodynamics (IV edition) by J. M. Smith & Vanness, (McGraw-Hill Co.)
7	Chemistry in Engineering and Technology, (volume I & II) J C Kuriacose & J. Rajarah (Tata McGarw Hill).
8	Chemistry of Engineering Materials By Jain &Jain. (Dhanpairai Publishing Co.).

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)
B. Sc. (UG) Semester – III

Course Code	**US03CICH52**	Title of the Course	**Organic Chemistry**
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	To make students familiar with: 1. Organic Chemistry as a subject. 2. Historic development and scope of organic chemistry. 3. Basic concepts related to phenols, alcohols, ethers & epoxides, amines, aldehydes, ketones, carboxylic acids & their derivatives, polymer nuclear, heterocyclic compounds.

Course Content		
Unit	Description	Weightage* (%)
1.	Phenols, Alcohols, Ethers & Epoxides And Amines. 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. Ethers - Structure, Nomenclature, Preparation, Physical properties, Reactions, Cyclic ethers, Epoxides. Preparation and reactions. Amines - Structure, Nomenclature, Preparation & Reactions, Salts of amines, Basicity of amines, Hoffman elimination, Analysis of amines, Diazonium salts -Synthesis, reaction and characteristics.	**25%**
2.	Aldehydes, Ketones, Carboxylic Acids & their derivatives. Structure, Classification, Nomenclature, Preparation, Physical properties, Reactions, Nucleophilic addition reactions, Base promoted halogenation of ketones, Acid catalyzed halogenation of ketones. Salts of carboxylic acids, Acidity of carboxylic acids, Effect of substituents on acidity, reactions of acid chloride, Acid anhydrides.	**25%**
3.	Heterocyclic compounds. Nomenclature of heterocyclic systems, five member heterocycles - Structure, source and electrophilic substitution reaction in Pyrrole, Thiophene and furan. Six membered heterocycles - Structure and source of pyridine compounds, nucleophilic and electrophilic	**25%**

	substitution reaction in pyridine, basicity of pyridine, reduction of pyridine.	
4.	Polynuclear hydrocarbons. Introduction, Nomenclature, Structure, Preparation and Reactions of Naphthalene, Anthracene and Phenanthrene.	**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).

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 concept related to Phenols, Alcohols, Ethers & Epoxides, Amines, Aldehydes, Ketones, Carboxylic Acids, polymer nuclear, Heterocyclic compounds.
2.	Apply this knowledge in further studies of third year B.Sc. Industrial Chemistry course.

Suggested References:

Sr. No.	References
1.	Chemistry of carbonyl compounds by Cautsche – Prentice Hall.
2.	Organic Chemistry by M. K. Jain and S. C. Jain (Shoban LAl Nagin Chand &

	Co. Educational Publishers, Jalandhar).
3.	Organic Chemistry by Robert T. Morrison and Robert T. Boyd (VIth Edition, Prentice Hall of India Pvt. Ltd. New Delhi)
4.	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)
B. Sc. (UG) Semester – III

Course Code	**US03CICH53**	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 binary organic mixture separation, identification and derivatives preparation. 3. Basic concepts related to cement analysis.

Course Content	
Practical	Description
I	Calibration of glassware and preparation of solutions & its standardization. Cement analysis: To determine loss on ignition of cement sample, Total Insoluble residue in Cement sample, Total silica in given sample, Total Oxides in given sample, Amount of lime, Amount of magnesia, Amount of iron as Fe_2O_3 in given sample, Material balance, Titration, Experiments based of Adsorption phenomena: Adsorption of Oxalic acid on activated charcoal. Determination of adsorption isotherm of acetic acid on activated charcoal. Determination of Copper and Nickel in the given solution, Estimation of ferrous and ferric ion in the given solution.
II.	Organic Spotting: a binary mixture, separation, identification and derivatives preparation. Experiments based on lab skill enhancement for preparation of laboratory (Preparation and Standardization of laboratory solution). Synthesis of simple hetrocyclic compounds.

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).

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 organic mixture.
2.	Know about preparation of standard solutions, Calibration of glassware and preparation of solutions & its standardization. Cement analysis. This will improve practical skills of students.

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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(Bachelor of Science)(Undergraduate)

B. Sc. (UG) Semester –III

Course Code	**US03SICH51**	Title of the Course	**Industrial Pollution and Safety**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Basic of Water Pollution and its source. 2. Concepts of Atmosphere, Eco-System and Air Pollution. 3. Introduction to occupational health and safety.

Course Content		
Unit	Description	Weightage* (%)
1.	Atmosphere, Eco-System and Air Pollution, Sources and Effect of Air Pollutants, Green House Effect, Air Pollution control Technique, Noise pollution and its control Technique.	**25%**
2.	Water Pollution and its source, Types of water pollutants and their adverse effects, Waste water treatment, BOD and COD tests, Pesticide Pollution and sound pollution.	**25%**
3.	Solid Waste Management, Collection and Disposal of solid waste, Radio activity and Radiation Pollution, Pollution Statutory limits. Biomedical waste and e-waste generation, Characteristics, classification, collection, transportation and disposal, Noise pollution.	**25%**
4.	Introduction to occupational health and safety, Workplace hazards, Hazard assessment techniques in chemical industry. Ergonomics hazard. Control of work place hazards - work equipment hazards, electric, chemical, biological and psychological hazards. Laboratory Safety, Safety Practice, Factory acts.	**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).

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 occupational health and safety, Water Pollution and its source, Concepts of Atmosphere, Eco-System and Air Pollution.
2.	Apply knowledge in further studies of third year B.Sc. Industrial chemistry course.

Suggested References:	
Sr. No.	References Books
1.	Environmental Chemistry, B. K. Sharma (Krishna Prakashan Media (P) Ltd., Meerut).
2.	Environmental Pollution Control Engineering, C. S. Rao (Wiley Eastern Ltd., New Delhi)
3	Engineering Chemistry, Jain and Jain (Dhanpat Rai and Sons)
4	Introduction to Environmental Engineering and Science, G. M. Masters.
5	Environmental pollution, H. N. DIX (J.W & Sons).
6	Chemical technology, Vol I, D. Venkateshwaraly (C. Chand & co)
7	Hand book of human factor and ergonomics by Salvendy, Jhon Wiley and sons.
8	Occupational safety and health by David L Goetsch.
9	Electronic waste management by Ronald E. Hester and Roy M Harrison.

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

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