ARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.11)
Syllabus with effect from the Academic Year 2024-2025

B.Sc. (Industrial Chemistry) Sem. 3

Course Code (Major)	US03MAICH01	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. Concepts of Material science and alloys. 2. Basis of calculation related to Mole fraction, material balance, units etc. 3. Basic concepts of Glass, Cement, Ceramics and Refractories.

Course Content		
Unit	Description	Weightage*(%)
1.	Material Sciences: Introduction s of material sciences, Classification of engineering materials, Engineering requirements of materials, Plan for selection of materials Metals and Alloys: Introduction, preparation, Mechanical & chemical properties, Applications, Composition of important metals and alloys- iron, copper, aluminum, and their alloys.	25%
2.	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, Bypass operation.	25%
3.	Glass: Introduction, Physical and Chemical properties of glass, Characteristics of Glass, Raw materials, Types of glasses, Methods of Manufacture of glass and uses. Cement: Introduction, Other types of cement, Type of Portland cement, Raw materials, Manufacturing of cement, setting of cement, Properties of cement, and hardening of cement, uses of cement.	25%
4.	Ceramic industries: Introduction, General Properties of ceramics, Permeable and impermeable wares, Classification based on reduction in porosity, Raw materials, Manufacturing Process, Application and uses. Refractory: Introduction, Classification of refractories, Properties of refractories, Manufacture of refractories, Important refractory, Selectionand failure of refractories.	25%

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered inthe classroom, in an 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 (As per NEP 2020)	50%

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.	Learn about Glass, Cement and Ceramics industries and their process of manufacturing.

Suggested References:	
Sr. No.	References
1.	Industrial Chemistry by B. K. Sharma
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 (NiraliPrakashan-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) JCKuriacose&J.Rajarah(Tata McGraw Hill).
8.	Chemistry of Engineering Materials by Jain & Jain.(Dhanpairai Publishing Co.).

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

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B.Sc. (Industrial Chemistry) Sem. 3

Course Code (Major)	US03MAICH02	Title of the Course	Organic Chemistry
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	To make students familiar with: 1. The fundamental concepts of organic chemistry & chemistry of Heterocyclic compounds. 2. Basic knowledge of the stereochemistry.

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 substitution reaction in pyridine, basicity of pyridine, reduction of pyridine.	25%
4.	Stereochemistry Stereoisomerism, Polarimeter, specific rotation, chirality, enantiomers, diastereomers, meso compound,Racemic modification, optical activity, configuration, specification of configuration: R & S, conformational isomers, reactions involving stereoisomers.	25%

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry program are delivered through classroom, 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 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 (As per NEP 2020)	50%

Course Outcomes: Having completed this course, the learner will be able	
1.	To understand and explain the functional behavior of Phenols, Alcohols, Ethers & Epoxides and Amines compounds
2.	To understand preparation, properties and reactions of Aldehydes, Ketones, Carboxylic Acids & their derivatives.
3.	To acquire basic knowledge of preparation, properties and reactions of N, O, and S containing heterocyclic compound.
4	To understand the basic of stereochemistry, physical properties of isomers, and applications of the organic stereochemistry.

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 LAlN agin 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).
5.	Stereochemistry of Organic Compounds 2008 Edition by Samuel H. Wilen, Wiley.
6.	Introduction to Stereochemistry, 1st Edition by Andrew Clark (Author), RSC, 2020.

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

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B. Sc. (Industrial Chemistry) Semester – III

Course Code (Major Practical)	US03MAICH03	Title of the Course	Practical
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	Develop the skill to analyze and identify the materials, its testing chemicals, Develop skills in the scientific method of calibrating the glassw are. Enhance the skill of preparation and standardization of analytical solutions. Develop skills in understanding, planning and performing experiments for titrimetric analysis.

Course Content
Part: I (02 Credit ; 04 Hours per week) ➢ Calibration of Volumetric Glassware and preparation of solutions ➢ Testing of Metals and Alloys ➢ Material Balance calculations ➢ Cement analysis Part:II (02 Credit ; 04 Hours per week) ➢ Organic qualitative analysis f binary mixture. ➢ Purification and separations techniques.

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.	University Examination NEP 2020	100%

Course Outcomes: Having completed this course, the learner will be able to Acquire practical knowledge of basic chemical laboratory tools and analytical concept and organic chemistry for the subject of industrial chemistry.

Suggested References:

1. Brian S. Furniss (1989, 5th edition) *Vogel's Textbook of Practical Organic Chemistry*. Hoboken: John Willey & Sons (ISBN: 0-582-462363).
2. Hassner, A. (2012, 3rd edition) *Organic Syntheses Based on Name Reactions. Philadelphia*: Elsevier Publishing company (ISBN: 978-0-08-096630-4).
3. Jeffery, G. H.; Bassett, J.; Mendham, J.; Denny, R. C. (1989, 5th edition) *Vogel's Textbook of Quantitative Chemical Analysis*. Hoboken: John Willey & Sons (ISBN: 0-582-44693-7).

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

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

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B.Sc. (Industrial Chemistry) Sem. 3

Course Code (Inter Disciplinary)	US03IDICH01	Title of the Course	Engineering Materials
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Basis of concept of engineering materials. 2. Basic concepts of Glass, Cement, Ceramics and Refractories.

Course Content		
Unit	Description	Weightage*(%)
1.	Glass: Introduction, Physical and Chemical properties of glass, Characteristics of Glass, Raw materials, Types of glasses, Methods of Manufacture of glass and uses. Cement: Introduction, Other types of cement, Type of Portland cement, Raw materials, Manufacturing of cement,setting of cement, Properties of cement, and hardening of cement,uses of cement.	25%
2.	Ceramic industries: Introduction, General Properties of ceramics, Permeable and impermeable wares, Classification based on reduction in porosity, Raw materials, Manufacturing Process, Application and uses. Refractory: Introduction, Classification of refractories, Properties of refractories, Manufacture of refractories, Important refractory, Selection and failure of refractories.	25%

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Industrial Chemistry programs are delivered inthe classroom, in an 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 (As per NEP 2020)	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Concept of engineering material and its importance.
2.	Learn about Glass, Cement and Ceramics industries and their process of manufacturing.

Suggested References:	
Sr. No.	References
1.	Industrial Chemistry by B. K. Sharma
2.	Basic Principles & Calculation in Chemical Engineering, David M Himnelblan (Prentice Hall Inc.)
3.	Chemical Process Calculation (Stoichiometry), K. A. Gavhane (NiraliPrakashan-Pune)
4.	Chemistry of Engineering Materials by C. V.Agrawal(Tara Publication)
5.	Introduction to Chemical Engineering Thermodynamics (IV edition) by J. M. Smith &Vanness, (McGraw-Hill Co.)
6.	Chemistry in Engineering and Technology, (volume I&II) JCKuriacose&J.Rajarah(Tata McGraw Hill).
7.	Chemistry of Engineering Materials by Jain & Jain.(Dhanpairai Publishing Co.).

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B.Sc. (Industrial Chemistry) Sem. 3

Course Code (Inter Disciplinary)	US03IDICH02	Title of the Course	Practical
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	Develop the skill to analyze engineering materials and its testing.

Course Content
(02 Credit ; 04 Hours per week) ➢ Calibration and standarzation of laboratory tools ➢ Experiments based Glass and cement analysis. ➢ Analysis of raw materials for Ceramic industries and Refractory.

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.	University Examination (As per NEP 2020)	100%

Course Outcomes: Having completed this course, the learner will be able to Acquire practical knowledge of basic chemical laboratory tools and analytical concept Ceramic industries
Refractory for the subject of industrial chemistry.

Suggested References:
1. Brian S. Furniss (1989, 5th edition) *Vogel's Textbook of Practical Organic Chemistry*. Hoboken: John Willey & Sons (ISBN: 0-582-462363). 2. Jeffery, G. H.; Bassett, J.; Mendham, J.; Denny, R. C. (1989, 5th edition) *Vogel's Textbook of Quantitative Chemical Analysis*. Hoboken: John Willey & Sons (ISBN: 0-582-44693-7).

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