



Bachelor of Science – Industrial Chemistry (Undergraduate Programme Without Research)
B. Sc. (UG) Semester – VII (Effective from JUNE 2026)

Course Code (Major)	US07HMAICH01	Title of the Course	Selected Topics in Industrial Organic Chemistry-I
Total Credits of the Course	4	Hours per Week	4

Course Objectives	To familiarize students with: • Key rearrangement and reduction reactions involved in organic synthesis. • The role and applications of commonly used reagents in industrial chemical processes. • Aroma compounds and the chemistry of perfumes used in fragrance industries. • The basic chemistry and industrial importance of detergents and explosive compounds.
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Course Content		
Unit	Description	Weightage*(%)
1.	Applications of Important Organic Reactions Birch reduction, Clemmensen reduction, Meerwein–Ponndorf–Verley reduction, Curtius reaction, Diels–Alder reaction, Knoevenagel reaction, Sandmeyer reaction, Sommelet reaction, Wittig reaction, Cannizzaro reaction, and Stork enamine reaction.	25%
2.	Rearrangements Allylic rearrangement, Dienone–phenol rearrangement, Fries rearrangement, Wolff rearrangement, Wagner–Meerwein rearrangement, and Curtius–Schmidt rearrangement. Important Reagents Fenton's reagent ($\text{H}_2\text{O}_2 + \text{Fe}^{2+}$), Raney nickel, sodium amide (NaNH_2), Wilkinson's catalyst, perbenzoic acid, and periodic acid.	25%
3.	Detergents Introduction and classification of detergents. Anionic surfactants, cationic surfactants, ampholytic surfactants, and non-ionic surface-active agents. Detergent builders and additives. Explosives Introduction and classification of explosives. Nitro explosives, nitric esters, nitramides, nitramines, guanidine explosives, diazo compounds, and other miscellaneous compounds.	25%
4.	Synthetic Perfumes Introduction to perfumes, vehicles, fixatives, and odorous substances. Types of perfume compounds including esters, alcohols, ketones, aldehydes, and diphenyl compounds. Synthesis and applications of the following perfumes from inexpensive raw materials: artificial (nitro) musk, coumarin, vanillin, linalool, ionones, methyl ionones, anisic aldehyde, cyclamen aldehyde, and hydroxycitronellal.	25%



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Teaching-Learning Methodology	The course will be delivered using conventional classroom blackboard teaching along with ICT-enabled methods. The B.Sc. Industrial Chemistry program will be taught through classroom instruction and laboratory work in a challenging, engaging, and inclusive environment that accommodates different learning styles. Various teaching tools such as PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models will be used to enhance students' understanding of the subject.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination (Written Examination - 20%; Assignments/Continuous Evaluation - 10%; Seminar/Presentation - 10%, Quiz - 5% and Attendance - 5%)	50%
2.	University Examination	50%

Course Outcomes: After successful completion of this course, students will be able to:	
1.	Understand the basic concepts, classification, and chemistry of dyes and coloring agents used in industry.
2.	Explain the synthesis, properties, and applications of important dyes and pharmaceutical compounds.
3.	Gain fundamental knowledge of pharmaceutical chemistry and its role in the treatment of diseases.
4.	Describe the importance of vitamins and hormones and their applications in the prevention and treatment of various diseases.

Suggested References:	
Sr. No.	References
1.	Synthetic Dyes – Gurdeep R. Chatwal, Himalaya Publishing House.
2.	Organic Chemistry – M. K. Jain and S. C. Sharma, Shoban Lal Nagin Chand & Co.
3.	Handbook of Synthetic Dyes and Pigments – K. M. Shah, Multi-Tech Publishing Co.

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



Bachelor of Science – Industrial Chemistry (Undergraduate Programme Without Research)
B. Sc. (UG) Semester – VII (Effective from JUNE 2026)

Course Code (Major)	US07HMAICH02	Title of the Course	Applied Unit Operations and Mass Transfer
Total Credits of the Course	4	Hours per Week	4

Course Objectives	To familiarize students with: • The basic principles of mass transfer operations used in chemical industries. • Important separation processes such as liquid–liquid extraction, drying, filtration, distillation, gas absorption, and leaching. • Equilibrium relationships and rate processes involved in different mass transfer operations. • The selection and functioning of industrial equipment such as extractors, dryers, filters, distillation columns, absorption towers, and leaching units.
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Course Content		
Unit	Description	Weightage*(%)
1.	Gas Absorption Basic principles of gas absorption and selection of suitable solvents. Effect of liquid-to-gas (L/G) ratio. Co-current and counter-current operations. Concept of HETP (Height Equivalent to a Theoretical Plate) in continuous contact equipment. Types of gas absorption equipment such as packed towers, tray towers, spray columns, and bubble columns. Leaching Principles of leaching. Batch and continuous leaching operations. Equipment used for leaching. Material balance and equilibrium-based calculations in leaching processes.	25%
2.	Drying Principles of drying and different expressions of moisture content. Drying rate curve for batch drying. Constant rate and falling rate periods. Critical and equilibrium moisture content. Calculations for cross-circulation and through-circulation drying. Rate of drying in continuous dryers. Rotary dryers and hold-up calculations. Filtration Basic theory of filtration and Darcy's law. Cake resistance and filter medium resistance. Constant-pressure and constant-rate filtration calculations. Types of filtration equipment. Filtration using centrifuges and related calculations.	25%



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3.	Distillation and Mass Transfer Fundamentals of mass transfer and diffusion. Mass transfer coefficients and Fick's law. Types of distillation: simple, fractional, steam, vacuum, and azeotropic distillation. Distillation equipment. Reflux ratio and its importance. Operational problems such as enrichment and weeping in columns. Design of multistage tray and packed towers using the Ponchon–Savarit (enthalpy–concentration) method.	25%
4.	Liquid–Liquid Extraction Principles of extraction and selection of suitable solvents. Distribution law and distribution coefficient. Ternary phase diagrams, binodal curve, tie lines, and plait point. Single-stage extraction calculations. Multistage extraction by cross-current and counter-current methods. Differential extractors and their working. Dimensional Analysis Rayleigh's method and Buckingham π theorem. Formation of dimensionless groups and their application in mass transfer operations.	25%

Teaching-Learning Methodology	The course will be delivered using conventional classroom blackboard teaching along with ICT-enabled methods. The B.Sc. Industrial Chemistry program will be taught through classroom instruction and laboratory work in a challenging, engaging, and inclusive environment that accommodates different learning styles. Various teaching tools such as PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models will be used to enhance students' understanding of the subject.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination (Written Examination - 20%; Assignments/Continuous Evaluation - 10%; Seminar/Presentation - 10%, Quiz - 5% and Attendance - 5%)	50%
2.	University Examination	50%

Course Outcomes : Having completed this course, the students will be able to:	
1.	Explain the basic principles of mass transfer and diffusion and describe important separation processes such as distillation, liquid–liquid extraction, gas absorption, drying, filtration, and leaching.
2.	Understand equilibrium relationships, rate processes, and dimensional analysis involved in mass transfer operations.
3.	Describe the working principles of industrial equipment used in different mass transfer operations such as distillation columns, extractors, dryers, filters, and absorption towers.



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4.	Apply basic material balance and graphical methods to solve simple problems related to mass transfer processes.
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Suggested References:

Sr. No.	References
1.	Mass Transfer Operations – Robert E. Treybal, McGraw-Hill, 3 rd Edition.
2.	Unit Operations of Chemical Engineering – Warren L. McCabe, Julian C. Smith, and Peter Harriott, McGraw-Hill, 7 th Edition.
3.	Fundamentals of Engineering Heat and Mass Transfer – R. C. Sachdeva, Wiley India.
4.	Basic Principles and Calculations in Chemical Engineering – David M. Himmelblau, Prentice Hall.
5.	Perry's Chemical Engineers' Handbook – Robert H. Perry, 7 th Edition.
6.	Mass Transfer: Theory and Practice – N. Anantharaman and K. M. Meera Sheriffa Begum.
7.	Transport Processes and Separation Process Principles – Christie J. Geankoplis.
8.	Mass Transfer Operations – Robert E. Treybal, McGraw-Hill.

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

Online Resources : Google Books, INFLIBNET, Google Web



Bachelor of Science – Industrial Chemistry (Undergraduate Programme Without Research)
B. Sc. (UG) Semester – VII (Effective from JUNE 2026)

Course Code (Major)	US07HMAICH03	Title of the Course	Industrial Chemistry - Practical
Total Credits of the Course	4	Hours per Week	8

Course Objectives	To familiarize students with: • Practical aspects of reaction mechanisms, process parameters, and industrial considerations involved in the synthesis and analysis of pharmaceutical, detergent, explosive, and perfume intermediates. • Quantitative organic analysis and functional group identification used for estimation and quality control of industrial chemical products and intermediates. • Physicochemical and analytical techniques such as pH measurement, conductometric titration, extraction, distillation, and water analysis. • The operation and calibration of laboratory instruments such as pH meter, conductometer, rotameter, viscometer, and refractometer while following proper laboratory safety practices.
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Course Content

Part-1:

Reaction mechanisms, process parameters, and industrial considerations in the synthesis of API intermediates. Reaction conditions, mechanisms, and process control involved in the manufacture of detergent and explosive intermediates.

Preparation of detergent intermediates containing functional groups such as sulfonic acid, sulfate, carboxylate, and phosphate groups. Synthesis of explosive intermediates through functional group transformations including nitration, nitro, nitramine, and nitrate ester formation.

Safety measures, handling procedures, and environmental considerations in the production and storage of these chemical intermediates. Quantitative organic analysis methods for the estimation of intermediates and finished API products. Functional group analysis and identification techniques for pharmaceutical intermediates.

Analytical methods for purity determination, assay, and quality control of APIs and their intermediates. Estimation and analysis of intermediates used in the perfume and fragrance industries. Industrial applications, safety measures, and regulatory aspects involved in the manufacturing of pharmaceutical and perfume intermediates.

Part-II

The determination of pH using a pH meter includes experiments such as the titration of a strong acid with a strong base, a weak acid with a strong base, and a mixture of acids with a strong base, in order to study the variation in pH and accurately determine the equivalence point. Conductometric titration experiments involve



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the titration of a strong acid with a strong base, a weak acid with a strong base, and a mixture of acids with a strong base, where changes in electrical conductivity are measured to identify the end point of the reaction. The practical work also includes Soxhlet extraction for the continuous extraction of a component from a solid using a suitable solvent, and simple distillation for the separation and purification of liquids based on differences in boiling points. Calibration and study of a rotameter are performed to understand flow measurement and to establish the relationship between flow rate and float position. The determination of alkalinity of water is carried out to estimate the presence of hydroxide, carbonate, and bicarbonate ions.

Teaching-Learning Methodology	The practical course for B.Sc. Industrial Chemistry students will be conducted through laboratory-based learning. Students will perform experiments under the guidance of the instructor to develop hands-on skills in analytical techniques, instrumentation, and chemical process operations. Demonstrations, observation of results, data recording, and laboratory reports will help students understand experimental principles, analyze results, and follow proper laboratory safety practices.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination (Internal Practical Examination - 30%; Viva Voce - 10%; Lab Journal/Record & Method of Working - 5% and Attendance & Laboratory Discipline - 5%)	50%
2.	University Examination (External Practical / Viva Voce)	50%

Course Outcomes : After successful completion of this practical course, students will be able to:	
1.	Understand and apply industrial reaction processes for the synthesis of pharmaceuticals, detergents, explosives, perfumes, and their intermediates.
2.	Perform quantitative analysis and quality control of chemical intermediates and products using functional group identification, titrations, and extraction techniques.
3.	Operate, calibrate, and interpret data from laboratory instruments such as pH meters, conductometers, and flow measurement devices.
4.	Maintain accurate records and follow safe laboratory practices, analyzing experimental observations for process understanding and problem-solving.

Suggested References:	
Sr. No.	References
1.	Vogel's Textbook of Quantitative Chemical Analysis – G. H. Jeffery, J. Bassett, J. Mendham, and R. C. Denney, Pearson Education.



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2.	Practical Physical Chemistry, by Alexander Findlay, Longman.
3.	Instrumental Methods of Chemical Analysis, by Gurdeep R. Chatwal and Sham K. Anand, Himalaya Publishing House
4	Experimental Organic Chemistry – V. K. Ahluwalia, Universities Press.



Bachelor of Science – Industrial Chemistry (Undergraduate Programme Without Research)
B. Sc. (UG) Semester – VII (Effective from JUNE 2026)

Course Code (Minor)	US07HMIICH01	Title of the Course	Organizational Behavior and Human Resource Management
Total Credits of the Course	2	Hours per Week	2

Course Objectives	To familiarize students with: • The basic concepts of industrial psychology and their relevance in organizational settings. • Organizational behavior and the factors influencing employee performance and productivity. • Workplace issues such as stress, morale, leadership, and conflict management. • The fundamentals of Human Resource Management and its role in industrial organizations. • Key HR functions such as recruitment, training, performance appraisal, and employee development.
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Course Content		
Unit	Description	Weightage*(%)
1.	Industrial Psychology and Organizational Behavior Introduction to industrial psychology and its significance in organizations. Organizational behavior and its impact on productivity. Individual differences and workplace behavior. Attitude—meaning, formation, and change. Frustration and its causes in industry. Morale and factors influencing employee morale. Group processes and group dynamics. Stress and stress management techniques. Leadership—meaning, qualities, and leadership styles. Industrial fatigue and its effects. Types of conflicts in organizations and their resolution methods.	50%
2.	Human Resource Management Introduction to Human Resource Management (HRM) and its objectives. Functions of HRM in industrial organizations. Human resource planning. Acquisition of human resources including recruitment, selection, placement, and induction. Development of human resources through training and development, performance appraisal, motivation, and career planning. Role of HRM in improving organizational effectiveness.	50%

Teaching- Learning Methodology	The course will be delivered using conventional classroom blackboard teaching along with ICT-enabled methods. The B.Sc. Industrial Chemistry program will be taught through classroom instruction and laboratory work in a challenging, engaging, and inclusive environment that accommodates different learning styles. Various teaching tools such as PowerPoint presentations, audio-visual resources, e-resources, seminars, workshops, and models will be used to enhance students' understanding of the subject.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination (Written Examination - 10%; Assignments/Continuous Evaluation - 5%; Seminar/Presentation - 5%, and Quiz/Attendance - 5%)	50%
2.	University Examination	50%

Course Outcomes : After successful completion of this course, students will be able to:	
1.	Explain the basic principles of industrial psychology and organizational behavior in workplace environments.
2.	Understand factors affecting employee behavior such as attitude, motivation, stress, morale, and leadership.
3.	Analyze group dynamics, workplace conflicts, and their methods of resolution in organizations.
4.	Describe the functions and importance of Human Resource Management in industrial organizations, including practices such as recruitment, training, performance appraisal, and career development.

Suggested References:	
Sr. No.	References
1.	Marketing Management – Philip Kotler, Prentice-Hall India, 9 th Edition.
2.	Personnel / Human Resource and Personnel Management – D. A. DeCenzo and S. P. Robbins, PHI India, 3 rd Edition.
3.	Industrial Marketing Strategy – Frederick Webster, 3rd Edition, John Wiley & Sons.
4.	Organizational Behavior – Stephen P. Robbins and Timothy A. Judge.
5.	Human Resource Management – K. Aswathappa.
6.	Personnel Management and Industrial Relations – P. C. Tripathi.
	On-line resources to be used if available as reference material
	Online Resources : Google Books, INFLIBNET, Google Web



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B. Sc. (UG) Semester – VII (Effective from JUNE 2026)

Course Code (Minor)	US07HMIICH02	Title of the Course	Organizational Behavior and Human Resource Management – Practical (Case Studies)
Total Credits of the Course	2	Hours per Week	4

Course Objectives	To familiarize students with: • The basic concepts of industrial psychology and organizational behavior in industrial settings. • Leadership, stress management, and conflict resolution in workplace environments. • Human resource practices such as recruitment, training, and performance appraisal in industries. • Management practices and employee development strategies used in chemical industries.
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Course Content
Students will prepare and present PowerPoint presentations (PPTs) on topics related to industrial psychology, organizational behavior, and human resource management in chemical industries. The presentations will include themes such as leadership styles in industrial organizations, stress and conflict management in the workplace, recruitment and selection processes in chemical companies, and training, development, and performance appraisal systems used in industries.

Teaching- Learning Methodology	The course for B.Sc. Industrial Chemistry students will be delivered through interactive classroom sessions supported by PowerPoint presentations, discussions, and case studies related to industrial organizations. Students will prepare and present presentations on topics related to industrial psychology and human resource practices in chemical industries. These activities will encourage active participation, improve communication skills, and help students understand workplace behavior and management practices.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination (Internal Practical Examination – 15%; Viva Voce – 5%; Lab Journal / Record & Method of Working – 2.5%; and Attendance & Laboratory Discipline – 2.5%)	50%
2.	University Examination (Practical + Viva Voce)	50%



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

1.	Explain the basic concepts of industrial psychology and organizational behavior in industrial environments.
2.	Understand leadership styles, stress management, and conflict resolution strategies used in organizations.
3.	Describe human resource practices such as recruitment, training, and performance appraisal in industries.
4.	Develop presentation and communication skills through seminars on industrial management topics.



Bachelor of Science – Industrial Chemistry (Undergraduate Programme Without Research)

B. Sc. (UG) Semester – VII (Effective from JUNE 2026)

Course Code	US07HMAHOJT1	Title of the Course	On-the-Job Training – I (Experiential Learning / Industrial Training)
Total Credits of the Course	6	Hours per Week	12

Course Objectives	To familiarize students with: • Practical exposure to the functioning of chemical and allied industries. • Relating theoretical concepts of industrial chemistry to real industrial practices. • Basic industrial operations, laboratory practices, and safety procedures followed in industry. • Observational, documentation, and professional skills through structured industrial training.
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Course Content : Description

During the training period, students may be exposed to the following activities depending on the nature of the host industry:

- Observation of industrial production processes carried out in chemical or allied industries.
- Exposure to laboratory activities and quality control practices followed in the organization.
- Familiarization with industrial safety measures and basic environmental practices.
- Interaction with technical personnel to understand routine industrial operations.
- Preparation and submission of a training report based on observations during the training period.

Teaching-Learning Methodology	The course will be conducted through supervised industrial training in chemical or allied industries. Students will learn mainly through observation of industrial processes, interaction with technical personnel and participation in permitted activities during the training period. Guidance will be provided by the industry mentor and faculty coordinator, and students will document their learning through a structured training report.
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Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination (Evaluation by Industry Mentor- 45%; Training Report/Log Book - 15%; and Internal Presentation/Viva - 15%)	50%
2.	University Examination (Evaluation of Training Report - 40% by External Examiner; and External Viva Voce/Presentation - 35%)	50%



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

1.	Understand the basic functioning of chemical or allied industries.
2.	Observe and relate industrial processes with the theoretical concepts studied in the programme.
3.	Become familiar with laboratory practices, quality control procedures and industrial safety measures.
4.	Develop professional communication skills and prepare a training report based on their industrial observations.

General Guidelines for On-the-Job Training (OJT):

1.	Students are required to undergo industrial training in a chemical or allied industry approved by the college/department.
2.	The training should normally be completed during the semester, and students are expected to complete about 180 hours of industrial training.
3.	Students must prepare and submit a training report based on their observations and learning during the training period.
4.	The training work will be evaluated by the college/ department through presentation and viva voce.
5.	Students and the concerned college/ department shall maintain necessary records related to the training, which may be produced before the university or competent authority whenever required.
6.	The implementation of OJT shall be subject to guidelines issued from time to time by the University and other competent authorities.
