FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of
INDUSTRIAL CHEMISTRY

I II

Course Curriculum

FOUR YEAR UNDERGRADUATE PROGRAM (NEP–2020)

Program: Bachelor in Science

DISCIPLINE–INDUSTRIAL CHEMISTRY

Session–2024-28

DSC-01to08		DSE-01to12		DGE-01to06	
Code	**Title**	**Code**	**Title**	**Code**	**Title**
ICSC-01T	Industrial Technology, Metallurgy and Surface Chemistry	ICSE-01T	Food Chemistry	ICGE-01T	Industrial Technology, Metallurgy and Surface Chemistry
ICSC-01P	Industrial Chemistry Lab. Course-I	ICSE-01P	Food Chemistry Lab. Course	ICGE-01P	Industrial Chemistry Lab. Course-I
ICSC-02T	Industrial Operations, Fuels and Aspects of Physical Chemistry	ICSE-02T	Environmental Remediation	ICGE-02T	Industrial Operations, of Physical Chemistry
ICSC-02P	Industrial Chemistry Lab. Course-II	ICSE-02P	Environmental Remediation Lab. Course	ICGE-02P	Industrial Chemistry Lab. Course-II
ICSC-03T	Polymeric Materials and Unit Processes in Organic Chemicals Manufacture	ICSE-03T	Data Analysis & Separation Techniques		
ICSC-03P	Industrial Chemistry Lab. Course-III	ICSE-03P	Data Analysis & Separation Techniques Lab. Course		
ICSC-04T	Unit Processes, Instrumentation and Industrial Safety	ICSE-04T	Inorganic Materials of Industrial Importance	SEC	
ICSC-04P	Industrial Chemistry Lab. Course-IV	ICSE-04P	Inorganic Materials of Industrial Importance Lab. Course	ICSEC-01T&P	Water Remediation & Conservation Studies
ICSC-05T	Industrial Economics & Instrumentation	ICSE-05T	Modern Analytical Techniques-I		
ICSC-05P	Industrial Chemistry Lab. Course-V	ICSE-05P	Modern Analytical Techniques-I Lab. Course		
ICSC-06T	Phermaceuticals	ICSE-06T	Organic Synthesis	VAC	
ICSC-06P	Industrial Chemistry Lab. Course-VI	ICSE-06P	Organic Synthesis Lab. Course	ICVAC-01T	Corrosion in Industry
ICSC-07T	Environmental Pollution Analysis	ICSE-07T	Energy Sources		
ICSC-07P	Industrial Chemistry Lab. Course-VII	ICSE-07P	Energy Sources Lab. Course		
ICSC-08T	Petrochemicals And Polymers	ICSE-08T	Manufacturing and Utilization Of Iron, Cement and Coal		
ICSC-08P	Industrial Chemistry Lab. Course-VIII	ICSE-08P	Manufacturing and Utilization Of Iron, Cement and Coal Lab. Course		
		ICSE-09T	Technology of Selected Finished Product – Dyes		
		ICSE-09P	Technology of Selected Finished Product – Dyes Lab. Course		
		ICSE-10T	Industrial Safety		
		ICSE-10P	Industrial Safety Lab. Course		
		ICSE-11T	Modern Analytical Techniques-II		
		ICSE-11P	Modern Analytical Techniques-II Lab. Course		
		ICSE-12T	Technology of Selected Finished Product – Drugs		
		ICSE-12P	Technology of Selected Finished Product – Drugs Lab. Course		

(Dr. A. K. Sharma)

FOUR YEAR UNDERGRADUATE PROGRAM (NEP–2020)

Program: Bachelor in Science

DISCIPLINE–INDUSTRIAL CHEMISTRY

Session–2024-28

Program: B.Sc. Industrial Chemistry (2024-2028)

Program Outcome(PO)

PO-1: Students will acquire and apply a comprehensive understanding of scientific concepts of chemistry to effectively address challenges within the field.

PO-2: Students will demonstrate proficiency in designing, executing, and analyzing experiments, enabling them to investigate intricate problems in applied chemistry and related disciplines.

PO-3: Students will possess the skills necessary to develop innovative and sustainable solutions to significant environmental issues, utilizing appropriate tools and methodologies within the realm of applied chemistry.

PO-4: Students will demonstrate effective written and verbal communication skills, effectively conveying their ideas and findings in a clear and concise manner.

Program Specific Outcome(PSO)

PSO-1: In depth knowledge of basic and applied area of Industrial Chemistry.

PSO-2: Capability to demonstrate knowledge and understanding of major chemistry concepts, theoretical principles and experimental findings and ability to use modern instrumentation techniques with chemical analysis and separation.

PSO-3: Develop scientific logics and approaches towards problems with critical reasoning and able to enhance the ability to assimilate, discuss scholarly articles and research papers showcasing interdisciplinary areas of industrial chemistry and capability for asking questions relating to issues and problems in the field of industrial chemistry.

PSO-4: Will develop ability to scale up chemical products and techniques developed at laboratory to the industrial level. The course will take students beyond chemistry knowledge into the world of industrial professionals.

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF INDUSTRIAL CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in Science (Honors/Honors with Research)		Semester - I	Session: 2024-2025
1	Course Code	ICSC-01T	
2	Course Title	INDUSTRIAL TECHNOLOGY, METALLURGY AND SURFACE CHEMISTRY	
3	Course Type	DSC	
4	Pre-requisite (if, any)	*As per program*	
5	Course Learning Outcomes (CLO)	➢ *To explores the principles behind metal extraction and modification of crucial industrial materials.* ➢ *To gain expertise in unit operations like distillation, absorption, evaporation, filtration, and drying, essential for industrial chemical processes.* ➢ *To Analyze separation techniques and equipment selection* ➢ *To optimize industrial processes for efficient metal extraction and material production.*	
6	Credit Value	3 Credits	*Credit = 15 Hours - learning & Observation*
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Metallurgical Operations:** [A] Basic metallurgical operations: pulverization, calcination roasting and refining. [B] Physico-chemical principles of extraction of Lead, Silver, Aluminium, Magnesium, Zinc, Chromium **Ancient Indian Metallurgy:** General Introduction of Ancient Indian Chemical Techniques- Metallurgy, Dyes, Pigments, Cosmetics- their production and uses. Chemistry of Ancient Metals- Gold, Silver, Copper, Iron, Tin, Lead and Mercury- their extraction and uses.	12
II	**Inorganic materials of industrial importance:** Their availability, forms, structure and modification. Alumina, Silica, Silicates, Clays, Mica, Carbon, Zeolites.	11
III	**Chemical Technology - I** **[A] Distillation**-Introduction: Batch & continuous distillation, separation of azeotropes, plate columns and packed columns. **[B] Absorption** - Introduction, Equipments - Packed columns, spray columns, bubble columns, packed bubble columns, mechanically agitated contractors.	11
IV	**Chemical Technology - II** **[A] Evaporation**-Introduction, Equipments short tube (standard) evaporators, forced circulation evaporators, falling film evaporators, climbing film (Upward flow) evaporators. **[B] Filtration**- Introduction, filter media and filter aids, equipments – plate and frame, filter Press, notch filter, rotatory drum filter, sparkler filter, candle filter, bag filter, and centrifuge. **[C] Drying** – Introduction, free moisture, bound moisture, Equipments, tray dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.	11
Keywords	***Metallurgy, Ancient Indian Techniques, Extraction, Materials, Distillation, Separation, Processing***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended-

1. *Raghavan, V. (2018). Physical metallurgy: An introduction (5th ed.). Pitamber Publishing.*
2. *Chakravarty, A. K. (2010). Fundamentals of adsorption (2nd ed.). New Age International Publishers.*
3. *Narayanan, K. V., & Babu, B. C. (2017). Stoichiometry and process calculations (2nd ed.). PHI Learning Private Limited.*
4. *Gupta, O. P. (2006). Chemical process technology (Vol. 1 & 2). Khanna Publishers.*
5. *Verma, H. S. (1989). Principles of extractive metallurgy (Vol. 1 & 2). CBS Publishers & Distributors.*

Reference Books Recommended-

1. *Perry, R. H., Green, D. W., & Maloney, J. O. (2007). Perry's chemical engineers' handbook (8th ed.). McGraw-Hill Education.*
2. *Badger, W. L., & Banchero, J. J. (1965). Introduction to Chemical Engineering. McGraw-Hill.*
3. *Chattopadhyay, P. (2000). Unit Operations of Chemical Engineering (Vol. 1). Khanna Publishers.*
4. *Adamson, A. W. (1990). Physical chemistry of surfaces (6th ed.). John Wiley & Sons.*
5. *Dara, S. S. (2008). A Text Book of Engineering Chemistry. S Chand & Co Ltd.*

Text Books Recommended -

Online Resources–

e-Resources / e-books and e-learning portals

- **https://www.scientificamerican.com/**
- **https://www.springer.com/journal/10853**
- **https://www.sciencedirect.com/journal/chemical-engineering-science**
- **https://www.niser.ac.in/**
- **https://www.tms.org/**

Online Resources–

- **e-Resources / e-books and e-learning portals**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks
Continuous Internal Assessment (CIA): 30 Marks
End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 / 20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts.,1out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF INDUSTRIAL CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Science *(Certificate / Diploma / Degree/Honors)*			**Semester - I**	**Session: 2024-2025**
1	**Course Code**	**ICSC-01P**		
2	**Course Title**	**INDUSTRIAL CHEMISTRY LAB. COURSE-I**		
3	**Course Type**	**DSC**		
4	**Pre-requisite** (if, any)	*As per program*		
5	**Course Learning. Outcomes (CLO)**	➢ *Identify potential safety hazards in a chemistry laboratory.* ➢ *Become familiar with common laboratory safety procedures and protocols.* ➢ *Learn about the appropriate Personal Protective Equipment (PPE) for various situations.* ➢ *Understand the importance of safe handling and disposal of chemicals.*		
6	**Credit Value**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	**Introduction to laboratory safety rules and regulations.** Identification of common hazards in the lab, including:Flammable liquids, Corrosive chemicals Toxic substances, Electrical hazards, Glassware breakage, Demonstration and practice of safe laboratory practices **Introduction to standard solutions and their applications.** Distinguishing between primary and secondary standards with examples. Gravimetric preparation of a primary standard solution Standardization of a secondary standard solution **Introduction to temperature measurement and the significance of accuracy.** Explanation of the concept of calibration and its necessity. Calibration of a laboratory thermometer using a reference standard (e.g., mercury thermometer) at different temperatures. Preparation of buffers: Identifying suitable weak acids and conjugate bases for buffer preparation Selecting appropriate buffer components based on desired pH range **Preparation Methods:** Calculating the amounts of acid and conjugate base needed for buffer solutions Chromatography- **Column Chromatography:** Theory and applications of separation based on adsorption, partition, and size exclusion. **Paper Chromatography:** Principles of separation on paper media, visualization techniques, and applications. **Thin Layer Chromatography (TLC):** Introduction to TLC plates, solvent systems, development techniques, and applications **Preparation of colloids:** Dispersion methods for preparing colloids, Aggregation and stabilization techniques for colloids	**30**

Keywords	Common Hazards, Toxic Chemicals, Standard Solutions, Calibration, Buffers, Chromatography, Colloids

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. *Tandon, M. M. N., (2012). BSc. Practical Chemistry. Shiva Lal Agarwal & Company.*
2. *Ahluwalia, V. K., Dhingra, S., & Dhingram, S. (2005). College Practical Chemistry. Universities Press.*
3. *Kamboj, P. C. (2014). Advanced University Practical Chemistry (Part I). Vishal Publishing Co.*
4. *Pandey, O. P., BajPai, D. N., Giri, S., (2013). Practical Chemistry, S. Chand.*

Reference Books Recommended -

1. *Seiler, J.P. (2005). Good Laboratory Practices: the why and how. Springer-Verlag Berlin and Heidelberg GmbH & Co. K; 2nd ed.*
2. *Garner, W.Y., Barge M.S., Ussary. P.J. (1992). Good Laboratory Practice Standards:Application for field and Laboratory studies. Wiley VCH.*

Online Resources–

- https://www.youtube.com/watch?v=0m8bWKHmRMM
- https://www.nist.gov/system/files/documents/srm/SP260-53.PDF
- https://www.khanacademy.org/science/chemistry/acids-and-bases-topic
- https://pubs.acs.org/doi/10.1021/acs.jchemed.1c00940 -
- https://www.rsc.org/membership-and-community/connect-with-others/through-interests/interest-groups/colloid-and-interface-science/

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS: