# FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

## Department of

# INDUSTRIAL CHEMISTRY

## 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 | | |

# 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.*<br>➢ *To gain expertise in unit operations like distillation, absorption, evaporation, filtration, and drying, essential for industrial chemical processes.*<br>➢ *To Analyze separation techniques and equipment selection*<br>➢ *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<br>**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**<br>**[A] Distillation**-Introduction: Batch & continuous distillation, separation of azeotropes, plate columns and packed columns.<br>**[B] Absorption** - Introduction, Equipments - Packed columns, spray columns, bubble columns, packed bubble columns, mechanically agitated contractors. | **11** |
| **IV** | **Chemical Technology - II**<br>**[A] Evaporation**-Introduction, Equipments short tube (standard) evaporators, forced circulation evaporators, falling film evaporators, climbing film (Upward flow) evaporators.<br>**[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.<br>**[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<br>Assignment / Seminar - **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks**<br>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.*<br>➢ *Become familiar with common laboratory safety procedures and protocols.*<br>➢ *Learn about the appropriate Personal Protective Equipment (PPE) for various situations.*<br>➢ *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.**<br>Identification of common hazards in the lab, including:Flammable liquids, Corrosive chemicals<br>Toxic substances, Electrical hazards, Glassware breakage, Demonstration and practice of safe laboratory practices<br>**Introduction to standard solutions and their applications.**<br>Distinguishing between primary and secondary standards with examples.<br>Gravimetric preparation of a primary standard solution<br>Standardization of a secondary standard solution<br>**Introduction to temperature measurement and the significance of accuracy.**<br>Explanation of the concept of calibration and its necessity.<br>Calibration of a laboratory thermometer using a reference standard (e.g., mercury thermometer) at different temperatures.<br>Preparation of buffers: Identifying suitable weak acids and conjugate bases for buffer preparation<br>Selecting appropriate buffer components based on desired pH range<br>**Preparation Methods:**<br>Calculating the amounts of acid and conjugate base needed for buffer solutions<br>Chromatography- **Column Chromatography:** Theory and applications of separation based on adsorption, partition, and size exclusion.<br>**Paper Chromatography:** Principles of separation on paper media, visualization techniques, and applications.<br>**Thin Layer Chromatography (TLC):** Introduction to TLC plates, solvent systems, development techniques, and applications<br>**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**<br>**A. Performed the Task based on lab. work - 20 Marks**<br>**B. Spotting based on tools & technology (written) – 10 Marks**<br>**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:***

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

| **PART- A: Introduction** | | | | |
|---|---|---|---|---|
| **Program: Bachelor in Science** *(Certificate / Diploma / Degree/Honors)* | | | **Semester - II** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSC-02T** | | |
| 2 | **Course Title** | **INDUSTRIAL OPERATIONS, FUELS AND ASPECTS OF PHYSICAL CHEMISTRY** | | |
| 3 | **Course Type** | **DSC** | | |
| 4 | **Pre-requisite** (if, any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes (CLO)** | ➢ ***Analyze the properties, advantages, and limitations of various fuel types and their combustion processes.***<br>➢ ***Evaluate the composition, refining processes, and applications of petroleum products and alternative fuels.***<br>➢ ***Explain the principles and technologies involved in boiler operation, water treatment, and fluid flow systems.***<br>➢ ***Differentiate between homogeneous and heterogeneous catalysis, exploring their applications in industrial reactions and enzyme-mediated processes.*** | | |
| 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 | **Fuel Chemistry:**<br>**[A] Fuel** - Types of fuels, advantages and disadvantages, combustion of fuels, calorific value<br>**[B] Petroleum:** Composition of crude petroleum, refining and petroleum products and their applications, fractional distillation of crude oil, natural gas, non petroleum fuels- CNG, LNG, biogas, fuels from biomass and wastes. Cracking, reforming, hydro forming, isomerization.<br>**[C] Coal**: Types, structure, properties, distillation of coal, chemicals derived from coal | **12** |
| II | **[A] Boilers**<br>Classification of boilers based on: Working pressure (low, medium, high), Heat source (fuel-fired, electric), Steam generation (fire-tube, water-tube), Fire-tube boilers (Lancashire boiler, Cornish boiler), Water-tube boilers (Babcock & Wilcox boiler, LaMont boiler), High-pressure boilers (Benson boiler), Electric boilers.<br>**[B] Water Treatment**<br>**Methods of Water Treatment:**<br>Pre-treatment methods: Sedimentation and filtration, Softening techniques ( ion exchange, lime-soda process), Degasification<br>Internal treatment methods: Boiler water conditioning with chemicals ( blowdown, phosphate dosing) | **11** |
| III | **[A] Fluid Flow**: Fans, blowers, compressors, vacuum pumps, ejector.<br>**[B]Pumps**: Reciprocating pumps, Gear pumps, centrifugal Pumps. | **11** |
| IV | **[A]Catalysis**: Introduction, Types, Homogeneous and Heterogeneous, Basic | **11** |

| | | |
|---|---|---|
| | principles, Mechanisms, factors affecting the performance.<br>**[B] Enzyme catalysis** - Rate model, industrially important reactions | |
| *Keywords* | ***Fuel Types, Combustion, Petroleum Refining, Alternative Fuels, Boilers, Water Treatment, Fluid Flow, Catalysis, Enzymes*** | |

***Signature of Convener & Members (CBoS) :***

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Vermani, O. P., & Narula, A. K. (2007). Industrial Chemistry. Galgotia Publications Pvt. Ltd.*
2. *Bhatia, S. C. (2014). Chemical Process Industries, Vol. I & II. CBS Publishers.*
3. *Jain, P. C., & Jain, M. (2012). Engineering Chemistry. Dhanpat Rai & Sons.*
4. *Gopalan, R., Venkappayya, D., & Nagarajan, S. (2016). Engineering Chemistry. Vikas Publication.*
5. *Sharma, B. K. (2018). Engineering Chemistry. Goel Publishing House.*
6. *Sharma, B. K. (2019). Industrial Chemistry. Goel Publishing House.*
7. *Puri, B. R., & Sharma, L. R. (2016). Physical Chemistry. Goel Publishing House.*

***Reference Books Recommended –***

1. *Stocchi, E. (Vol. 1). Industrial chemistry. Ellis Horwood Ltd.*
2. *Felder, R. M., & Rousseau, R. W. (2007). Elementary principles of chemical processes, Wiley*

**Online Resources–**

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

- **https://www.energy.gov/**
- **https://www.eia.gov/**
- **https://science.howstuffworks.com/environmental/energy/oil-refining.htm**
- **https://www.eia.gov/coal/**
- **https://www1.grc.nasa.gov/research-and-engineering/**
- **https://learncheme.com/**
- **https://www.nationalboard.org/**
- **https://www.asme.org/getmedia/c041390f-6d23-4bf9-a953-646127cfbd51/asme-bpvc-brochure-webview.pdf:**

**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**<br>Assignment / Seminar - **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks**<br>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 - II** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSC-02P** | | |
| 2 | **Course Title** | **INDUSTRIAL CHEMISTRY LAB. COURSE-II** | | |
| 3 | **Course Type** | **DSC** | | |
| 4 | **Pre-requisite** (if, any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes (CLO)** | ➢ ***Understand the theoretical principles behind various purification techniques.***<br>➢ ***Apply crystallization, distillation, and extraction methods in the laboratory for sample purification.***<br>➢ ***Analyze boiling point diagrams and interpret data from physical constant measurements.***<br>➢ ***Perform basic experiments to detect food adulteration.*** | | |
| 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** | Simple laboratory techniques crystallization, Fractional Crystallization,<br>Distillation, Fractional Distillation, Boiling Point Diagram.<br>Extraction Processes- Phase diagram, partition coefficient.<br>Depression and elevation in B.P. /M.P. of solids and liquids.<br>Ore analysis dolomite, limestone- calcite<br>Analysis of alloys such as cupro-nickel.<br>Determination of Physical constants: refractive-index, surface tension, effect of surfactants, on surface tension, viscosity, fluids, polymer solutions effect of additives on viscosity, optical rotation.<br>Study, experiments/ demonstration experiments.<br>Detection of food adulteration. | **30** |
| ***Keywords*** | ***Laboratory Techniques, Extraction, Ores analysis, Physical Constants, Food Adulteration*** | |

***Signature of Convener & Members (CBoS) :***

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Ahluwalia, V. K., & Aggarwal, R. (2000). Comprehensive practical organic chemistry: Preparations and quantitative analysis, Universities Press*
2. *Vishnoi, N. K. (2010). **Advanced practical organic chemistry** (3rd ed.). Vikas Publishing House.*

***Text Books Recommended –***

1. Vogel, A. I. (2012). Vogel's textbook of practical organic chemistry. Pearson Education.
2. Klein, D. R. (2012). Experimental organic chemistry. John Wiley & Sons.
3. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry. Brooks/Cole.
4. Nielsen, S. S. (2010). Food analysis laboratory manual. Food Science Text Series.

**Online Resources–**

- **https://chem.libretexts.org/**
- **https://www.khanacademy.org/science/chemistry**
- **https://www.chemguide.co.uk/**
- **https://pubs.acs.org/journal/ancham**
- **https://www.azom.com/**
- **https://www.virtualchemlab.com/**
- **https://www.sciencebuddies.org/science-fair-projects/references/science-fair-materials/measuring-food-adulteration**

## 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**<br>Assignment/Seminar +Attendance - **05**<br>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**<br>**D. Performed the Task based on lab. work - 20 Marks**<br>**E. Spotting based on tools & technology (written) – 10 Marks**<br>**F. Viva-voce (based on principle/technology) - 05 Marks** | **Managed by Course teacher as per lab. status** |

***Name and Signature of Convener & Members of CBoS:***

Indira

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

| **PART-A: Introduction** | | | |
|---|---|---|---|
| **Program: Bachelor in Science** *( Diploma / Degree/Honors)* | | **Semester-III** | Session:**2024-2025** |
| 1 | **Course Code** | **ICSC-03T** | |
| 2 | **Course Title** | **POLYMERIC MATERIALS AND UNIT PROCESSES IN ORGANIC CHEMICALS MANUFACTURE** | |
| 3 | **Course Type** | **DSC** | |
| 4 | **Pre-requisite(if, any)** | ***As per Government norms*** | |
| 5 | **Course Learning Outcomes(CLO)** | ➢ ***To have basic idea of materials, cement and ceramics, nature of materials their properties, applications, manufacturing of quality products and its economic relevance.***<br>➢ ***To understand polymeric material, glasses and composites, their properties, formation, crystallization, and structure with wide industrial applications.***<br>➢ ***To understand unit processes in organic chemicals manufacture involving nitration, halogenations, chloro-compounds, sulphonation and mechanism of processes.***<br>➢ ***To understand about oxidation reaction, commercial manufacture of important organic compound by oxidation with mechanism.*** | |
| 6 | **Credit Value** | **03Credits** | ***Credit = 15 Hours - learning & Observation*** |
| 7 | **Total Marks** | **Max.Marks:100** | **MinPassingMarks:40** |

## PART-B: Content of the Course

**Total No. of Teaching–learning Periods (01Hr.perperiod)**

| Module /Unit | Topics (Course contents) | No. of Period |
|---|---|---|
| I | **Material Science:**<br>Mechanical properties of material and change with respect to temperature.<br>**Cement:**<br>Types of cement, composition, manufacturing process, setting of cement.<br>**Ceramic:**<br>Introduction, Types, Manufacturing process, Applications, Refractories. | 11 |
| II | **Polymeric materials:**<br>Industrial polymer and composite materials, their constitution, chemical and physical properties, industrial applications.<br>**Glass:**<br>Types, composition, manufacture, physical and chemical properties, Applications.<br>**Corrosion**:<br>Various types of corrosion relevant to chemical industry - mechanism and preventive method. | 11 |
| III | **Nitration:**<br>Introduction, Nitrating agents, mechanism of nitration processes such as nitration of: - Paraffinic hydrocarbons, Benzene to nitrobenzene and m-dinitrobenzene, Chlorobenzene to o- and p-nitrochloro benzenes, Acetanilide to p-nitroacetanilide, | 12 |

| | | |
|---|---|---|
| | Toluene.<br>**Halogenation:**<br>Introduction-mechanism of halogenation reactions, reagents for halogenations, Halogenation of aromatic-side and nuclear halogenations, commercial manufacture of chlorobenzenes, chloral, monochloroacetic acid and chloromethane, dichlorodifluoro methane. | |
| **IV** | **Sulphonation:**<br>Introduction, sulphonating agents, chemical and physical factors in sulphonation. Mechanism of sulphonation reaction, Commercial sulphonation of benzene, naphthalene, alkyl benzene.<br>**Oxidation:**<br>Introduction, Types of oxidation reactions, oxidizing agents, mechanism of oxidation of organic compounds liquid phase oxidation, vapor phase oxidation, commercial manufacture of benzoic acid, maleic anhydride, phthalic anhydride, acrolein, acetaldehyde, acetic acid. | **11** |
| ***Keywords*** | ***Material science, cement and ceramics, polymeric materials, glass and corrosion, Nitration, halogenation, sulphation, oxidation.*** | |

***Signature of Convener & Members:***

## PART–C

**Learning Resources: TextBooks, Reference Books and Others**

***Textbooks Recommended–***

1. *Mahajan, S. P. (2009). Air Pollution Control. The Energy And Resources Institute (TERI).*
2. *Bhaskara, S., Fakrudeen, S. P., Raju, V. B., Murthy, H. A., & Raghu, A. V. (2021). Comparative Studies Of Inhibitive Effects Of Diamines On Corrosion Of Aluminium Alloy In Presence Of Acid Media. Rasayan J. Chem, 72-78.*

***Reference books Recommended–***

1. *Holdridge, D. A. (1963). GH Stewart Science of Ceramics. Vol. I London and New York (Academic Press For The British Ceramic Society), 1962. 334 Pp., Price£ 3. 5s. Mineralogical Magazine and Journal Of The Mineralogical Society, 33(261), 530-531.*
2. *Paul, A. (1989). Chemistry of Glasses. Springer Science & Business Media.*
3. *March, J. (1977). Advanced Organic Chemistry: Reactions, Mechanisms, And Structure (P. 825) New York: Mcgraw-Hill.*

**OnlineResources– e-Resources/e-booksande-learningportals**

- https://www.unsw.edu.au/science/our-schools/materials/engage-with-us/high-school-students-and-teachers/online-tutorials/ceramics#:~:text=Concrete%20is%20not%20officially%20a,the%20sand%20and%20aggregate%20particles.
- https://www.corrosionpedia.com/the-corrosion-of-polymeric-materials/2/1548#:~:text=Polymeric%20materials%20are%20not%20corrosion,of%20corrosion%20in%20these%20materials.&text=Polymeric%20materials%20have%20wide%20applications,to%20corrosion%20in%20these%20materials.
- https://dergipark.org.tr/en/download/article-file/1629713
- https://byjus.com/chemistry/benzene-reactions/

**Part-D:AssessmentandEvaluation**

**Suggested Continuous Evaluation Methods:**
**Maximum Marks: 100Marks**
**Continuous Comprehensive Evaluation(CCE): 30 Marks**
**Semester End Exam(SEE): 70 Marks**

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

***Name and Signature of Convener and Members of CBoS***

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

| **PART-A: Introduction** | | | | |
|---|---|---|---|---|
| **Program: Bachelor in Science** *( Diploma / Degree/Honors)* | | | **Semester-III** | Session:**2024-2025** |
| 1 | **Course Code** | **ICSC-03P** | | |
| 2 | **Course Title** | **INDUSTRIAL CHEMISTRY LAB. COURSE-III** | | |
| 3 | **Course Type** | **DSC** | | |
| 4 | **Pre-requisite(if, any)** | As per program ~~***Asper Government norms***~~ | | |
| 5 | **Course Learning Outcomes(CLO)** | ➢ *Understanding reactions with their mechanisms (e.g., nitration, sulphonation, Friedel-craft's reaction, etc.).*<br>➢ *Determination of flow control, flash point and ignition point.*<br>➢ *Understanding principles and working mechanisms of flow measuring devices.*<br>➢ *Conducting limit tests for heavy metals like, Pb, As, Fe, and ash content.* | | |
| 6 | **Credit Value** | **01Credit** | *Credit =30 Hours Laboratory or Field learning/Training* | |
| 7 | **Total Marks** | **Max.Marks:50** | **MinPassingMarks:20** | |

| **PART-B: Content of the Course** | | |
|---|---|---|
| **Total No. of Teaching–learning Periods (30Hr. per period)** | | |
| **Module** | **Topics(Course contents)** | **No. of Period** |
| **Lab./Field Training/ Experiment Contents of Course.** | **UNIT PROCESS:**<br>One to two examples of each of the following: -<br>Nitration, Sulphonation, Friedel-crafts reaction, Esterification, Hydrolysis, Oxidation, Halogenation, Chloro-Sulphonation, Reduction, Polymerization, Reaction of diazonium salts.<br>**PROCESS INSTRUMENTATION:**<br>Transducers of different types, use of Transducers for measuring flow control.<br>Determination of flash point and ignition points of liquids.<br>**FLOW MEASURING DEVICES:**<br>Floats, Monographs of representative raw materials such as sulphuric acid, toluene,<br>sodium carbonate, sodium hydroxide, carbon tetra chloride, benzoic acid (5-6 compounds).<br>**Limit Tests:**<br>Limit tests for heavy metals Pb, As, Hg, Fe, and ash content. | **30 (30Hrs.)** |
| *Keywords* | ***Unit process, Friedel-crafts reaction, Diazonium salts, process instrumentations, transducers, flow measuring devices, limit tests.*** | |

***Signature of Convener & Members:***

## PART–C

**Learning Resources: Text Books, Reference Books and Others**

***Textbooks Recommended–***

1. *Ahluwalia, V. K., & Aggarwal, R. (2001). Comprehensive practical organic chemistry: Preparation and quantitative analysis (1st ed.). Universities Press.*
2. *Ahluwalia, V. K., & Dhingra, S. (2004). Comprehensive practical organic chemistry: Qualitative analysis (1st ed.). Universities Press.*
3. *Behera, C. C. (2020.). Practical Lab Manual of Pharmaceutical Organic Chemistry – I, IP Innovative Publication*

***Reference books Recommended–***

1. *Furniss, B. S., Hannaford, A. J., Smith, P. W. G., Tatchell, A. R., & Vogel, A. I. (1996). Vogel's textbook of practical organic chemistry (5th ed.). Longman.*
2. *Mann, F. G., & Saunders, B. C. (Year). Practical Organic Chemistry. Pearson Publication*

**OnlineResources–**
**e-Resources/e-booksande-learningportals**

- https://byjus.com/chemistry/friedel-crafts-acylation-alkylation/
- http://www.saranathan.ac.in/attachments/eresources/ece/R2017/OIC751.pdf
- https://www.bspublications.net/downloads/059cc8f84560f2_Ch-1_Subba%20Rao_Practical%20Pharmaceutical%20In-organic%20Chemistry.pdf
- https://www.usp.org/sites/default/files/usp/document/harmonization/excipients/pf31-2-saccharin.pdf

## Part-D:AssessmentandEvaluation

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

***Name and Signature of Convener and Members of CBoS***

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

| **PART- A: Introduction** | | | | |
|---|---|---|---|---|
| **Program: Bachelor in Science** *( Diploma / Degree/Honors)* | | | **Semester - IV** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSC-04T** | | |
| 2 | **Course Title** | **UNIT PROCESSES, INSTRUMENTATION, AND INDUSTRIAL SAFETY** | | |
| 3 | **Course Type** | **DSC** | | |
| 4 | **Pre-requisite** (if, any) | ***As per Program*** | | |
| 5 | **Course Learning. Outcomes (CLO)** | ➢ *To gain knowledge about hydrogenation reactions, catalysts for hydrogenation, alkylation, alkylating agents, manufacture, and mechanism of organic compounds*<br>➢ *To understand aminolysis, aminating agents, amination reaction and their mechanism.*<br>➢ *To understand the concept of construction, principle and working of temperature and pressure measuring instruments.*<br>➢ *To know about liquid level measurement, density, viscosity filters, precipitators, eliminators, scrubbers, absorbers, and industrial safety measures.* | | |
| 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** | **Hydrogenation:**<br>Introduction, mechanism of hydrogenation reactions, catalysts for hydrogenation reactions, hydrogenation of vegetable oil. Manufacture of methanol from carbon monoxide and hydrogen, hydrogenation of acid and esters to alcohols, catalytic reforming.<br>**Alkylation:**<br>Introduction; Types of alkylation, alkylating agents. Mechanism of alkylation reactions, manufacture of alkyl benzene (for detergent manufacture), ethyl benzene, phenyl ethyl alcohol, N-alkyl anilines (mono and di methylanilines). | **12** |
| **II** | **Esterification**:<br>Introduction, hydrodynamics and mechanism of esterification reactions, Esterification by organic acids, by addition of unsaturated compounds, esterification of carboxy acid derivatives, commercial manufacture of ethyl acetate, dioctyl phthalate, vinyl acetate, cellulose acetate.<br>**Hydrolysis:** Introduction, hydrolyzing agents, mechanism of hydrolysis. | **11** |
| **III** | **Amination**<br>**By reduction**: Introduction, methods of reduction - metal and acid, catalytic, sulfide, electrolytic, metal and alkali sulfites, metal hydrides, sodium metal, concentrated caustic oxidation, reduction, commercial manufacture of aniline, m-nitro aniline, p-aminophenol.<br>**By aminolysis**: Introduction, aminating agents, factors affecting aminolysis. | **11** |
| **IV** | **(A). Process Instrumentation:** | **11** |

| | | |
|---|---|---|
| | Concept of measurement and accuracy, principle, construction and working of following measuring instruments.<br>**Temperature:**<br>Glass thermometers, bimetallic thermometer, pressure spring thermometer, vapour filled thermometers, resistance thermometers, radiation pyrometers.<br>**Pressure:** Manometers, barometers, bourdon pressure gauge, bellow type, diaphragm type pressure gauges, Macleod gauges, Pirani gauges, etc.<br>**(B) Liquid level:** Direct-indirect liquid level measurement, Float type liquid level gauge, ultrasonic level gauges, bubbler system, density measurement, viscosity \ measurement.<br>Bag filters, electrostatic precipitator, mist eliminators, wet scrubbers, absorbers, Industrial safety. | |
| *Keywords* | ***Hydrogenation, alkylation, esterification, hydrolysis, amination, reduction, aminolysis, process instrumentation, temperature, pressure, liquid level.*** | |

***Signature of Convener & Members (CBoS) :***

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *B. K. (2017). Industrial analysis. Gael Publication.*
2. *Shali, A. K., & Parikh, D. V. (2008). Introduction to industrial chemistry (5th ed.). Tata McGraw-Hill Education.*
3. *Mahajan, S. C., & Bhawalkar, V. D. (2010). Engineering chemistry (2nd ed.). Wiley India Pvt. Limited.*
4. *Chakraborti, D., & Chakraborti, A. K. (2014). Industrial chemistry (5th ed.). New Age International Publishers.*

**Reference Books Recommended-**

1. *Perry, J. H. (1950). Chemical engineers' handbook (1st ed.). McGraw-Hill.*
2. *Dunn, W. C. (2005). Fundamentals of industrial instrumentation and process control (1st ed.). McGraw-Hill.*
3. *Lipták, B. G. (Ed.). (2013). Process control: Instrument engineers' handbook (1st ed.). Butterworth-Heinemann.*
4. *Groggins, P. H., & Groggins, P. H. (1958). Unit processes in organic synthesis (1st ed.). McGraw-Hill*

**Online Resources–**

- **https://archive.nptel.ac.in/courses/104/101/104101115/**
- **https://nptel.ac.in/courses/104103023**
- **https://uodiyala.edu.iq/uploads/PDF%20ELIBRARY%20UODIYALA/EL43/Introduction to InstrumentationSensors and Process Control.pdf**
- **https://ecampusontario.pressbooks.pub/powerplantsystemsandcontrols/chapter/instrument-devices-level-measurement-and-control-2/**
- **https://mrcet.com/downloads/digital notes/ME/IV%20year/MAINTENANCE%20&%20SAFETY%20ENGINEERING%20DIGITAL%20NOTES.pdf**

**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):** | Internal Test / Quiz-(2): **20 +20**<br>Assignment / Seminar - **10**<br>Total Marks - **30** | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks |

| (By Course Teacher) | | |
|---|---|---|
| **End Semester Exam (ESE):** | **Two section – A & B**<br>Section A: **Q1.** Objective – **10 x1= 10** Mark; **Q2.** Short answer type- **5x4 =20 Marks**<br>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** *(Degree/Honors)* | | | **Semester - V** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSC-05T** | | |
| 2 | **Course Title** | **INDUSTRIAL ECONOMICS & INSTRUMENTATION** | | |
| 3 | **Course Type** | **DSC** | | |
| 4 | **Pre-requisite** (if, any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes (CLO)** | ➢ *To gain knowledge of the process of estimating the costs associated with completing a project within scope and according to its timeline.*<br>➢ *To determine the real value of assets and to fix the right price for products.*<br>➢ *To develop the ability to calculate profit and to learn about management skills and become efficient managers.*<br>➢ *To learn about the instrumental techniques useful in the industrial field.* | | |
| 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** | Factors involved in project cost estimation, Methods employed for the estimation of capital investment, Capital formation, Elements of cost accounting, Interest & investment cost, Time value of money equivalence, Depreciation, Method of determining depreciation, Taxes, Some aspects of marketing, Pricing policy | **12** |
| **II** | Profitability criteria, economics of selecting alternatives, variation of costs with capacity, break-even point, optimum batch sizes, production, scheduling, sampling of bulk materials, techniques of sampling of solids, liquids, and gases, collection & processing data, particle size determination, rheological properties of liquids, plastics, and their analysis & control, location of industry. | **11** |
| **III** | Industrial Organization, Concept of scientific management in industry, Functions of management: decision making, planning, organizing, directing, Materials management, Inventory control, Management of human resources: selection, incentives, welfare & safety. | **11** |
| **IV** | Instrumentation, UV-Visible Spectroscopy, IR Spectroscopy (non-dispersive IR), NMR Spectroscopy, Atomic Absorption & Flame Photometry, X-Ray Fluorescence, Ion-Selective Electrodes, Neutron Diffraction | **11** |
| *Keywords* | ***Cost pricing, capital formation, industrial organization, UV visible, IR, NMR, X-ray*** | |

***Signature of Convener & Members (CBoS) :***

| **PART–C: Learning Resources** |
|---|
| **Text Books, Reference Books and Others** |
| ***Text Books Recommended -*** |

***Text Books Recommended –***

1. *Tarachand (2010). Industrial Organization & Management (Vols. I & II). New Delhi, India: Everest Publishing House.*
2. *Khandelwal, O. P. (2009). Book on Management. New Delhi, India: Himalaya Publishing House.*
3. *Sharma, B. K. (2008). Instrumental Methods of Analysis. New Delhi, India: Goel Publishing House.*

***Reference Books Recommended –***


1. Bethel, L. L. (1998). Industrial Organization & Management. Upper Saddle River, NJ: Prentice Hall.
2. Elrich, R. F. (2017). Rheology: Theory & application (Vol. 5). Amsterdam, Netherlands: Elsevier.
3. Willard, H. H., Merit, L. L., & Dean, J. A. (2015). Instrumental Methods of Analysis. New Delhi, India: CBS Publishers.
4. Skoog, D. A., & West, D. M. (2013). Fundamentals of Analytical Chemistry Belmont, CA: Cengage Learning


**Online Resources–**

- https://www.udemy.com/course/industrial-instrumentation-and-control-devices/?couponCode=LEADERSALE24A
- https://onlinelibrary.wiley.com/journal/14676451
- https://ocw.mit.edu/courses/14-271-industrial-organization-i-fall-2005/
- https://business-school.exeter.ac.uk/module/?mod_code=BEEM015&ay=2023/4&sys=0

## 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**<br>Assignment / Seminar - **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks**<br>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 CHEMISTRY
## COURSE CURRICULUM

| **PART-A: Introduction** | | | | |
|---|---|---|---|---|
| **Program: Bachelor in Science** *(Certificate/Diploma /Degree)* | | | **Semester-IV** | Session:**2024-2025** |
| 1 | **Course Code** | **ICSC-04P** | | |
| 2 | **Course Title** | **INDUSTRIAL CHEMISTRY LAB. COURSE-IV** | | |
| 3 | **Course Type** | **DSC** | | |
| 4 | **Pre-requisite (if,any)** | ***As per Program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To analyze the sample with different instruments.*<br>➢ *To develop understanding of material testing.*<br>➢ *To understand the working mechanism of instruments and different material characterization techniques.*<br>➢ *To analyze the quality of different water samples.* | | |
| 6 | **Credit Value** | **01Credit** | *Credit =30 Hours Laboratory or Field learning/Training* | |
| 7 | **Total Marks** | **Max.Marks:50** | **MinPassingMarks:20** | |

**PART-B: Content of the Course**

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

| **Module** | **Topics(Coursecontents)** | **No.of Period** |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course.** | **INSTRUMENTAL METHODS OF ANALYSIS:**<br>Use of colorimeter, pH meter, Potentiometer, Conductometer, Refractometer, Polarimeter.<br>**MATERIAL TESTING-I: -**<br>Testing of alloys, Identification of plastics/rubber, estimation of yield point, Young's modulus, flaredness; Optical, Thermal, Mechanical and Electrical properties.<br>**MATERIAL TESTING-II: -**<br>Study of metallurgical microscope and sample preparation.<br>Preparation and study of microstructure of cast Irons.<br>Introduction to Nondestructive testing.<br>**WATER ANALYSIS:**<br>Solid contents, hardness, COD and other tests as per industrial specifications | **30 (30Hrs.)** |
| *Keywords* | ***Instrumental methods, Analysis, material testing, water, Young's modulus, cast iron, pH meter, conductometer, hardness, COD, microstructure.*** | |

***SignatureofConvener & Members:***

## PART–C

**LearningResources:TextBooks,ReferenceBooksandOthers**

***Text Books Recommended–***

1. *Sharma, B. K. (1981). Instrumental methods of chemical analysis. Krishna Prakashan Media.*
2. *Badwaik, H. R., Thote L.K.; Giri, T.K. (2022). Practical Handbook: Instrumental methods of analysis. VallabhPrakashan. Delhi, India.*

***Reference Books Recommended–***

1. *Clesceri, L. S. (1998). Standard methods for examination of water and wastewater. American publichealth association, 9*
2. *Rump, H. H. (1999). Laboratory manual for the examination of water, waste water and soil (No. Ed. 3). Wiley-VCH Verlag GmbH.*
3. *Krautkrämer, J., &Krautkrämer, H. (2013). Ultrasonic testing of materials. Springer Science & Business Media.*

**OnlineResources– e-Resources/e-booksande-learningportals**

- https://mlrip.ac.in/wp-content/uploads/2022/03/INSTRUMENTAL-METHODS-OF-ANALYSIS-LAB-MANUAL.pdf
- https://byjus.com/chemistry/environmental-chemistry/
- https://ebooks.inflibnet.ac.in/esp16/chapter/water-pollution/#:~:text=The%20amount%20of%20dissolved%20oxygen,dissolved%20oxygen%20than%20saline%20water.
- https://law.resource.org/pub/in/bis/S11/is.13360.5.1.1996.pdf
- https://www.accessengineeringlibrary.com/content/book/9780070707047/chapter/chapter10

## Part-D:AssessmentandEvaluation

**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**<br>Assignment/Seminar +Attendance **-05**<br>Total Marks - **15** | Better marks out of the two Test / Quiz **+**obtained marks in Assignment shall be considered against **15** Marks |
| **Semester End Exam(SEE):** | **Laboratory / Field Skill Performance: On spot Assessment**<br>**G. Performed the Task based on lab. work - 20 Marks**<br>**H. Spotting based on tools & technology (written) - 10 Marks**<br>**I. Viva-voce (based on principle/technology) - 05 Marks** | **Managed by Course teacher as per lab. Status** |

***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** *(Degree/Honors)* | | | **Semester-V** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSC-05P** | | |
| 2 | **Course Title** | **INDUSTRIAL CHEMISTRY LAB. COURSE- V** | | |
| 3 | **Course Type** | ~~**DSE**~~ DSC | | |
| 4 | **Pre-requisite(if, any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO )** | ➢ *To learn the synthesis of compound in laboratory.*<br>➢ *To learn the packaging of products*<br>➢ *To learn the testing of drug or crude materials.*<br>➢ *To understand the industrial need of lab.* | | |
| 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/performancePeriods:30 Periods (30 Hours)**

| Module | Topics(Coursecontents) | No. of Period |
|---|---|---|
| **Lab./Field Training / Experiment Contents of Course** | 1. Synthesis of common industrial compounds involving two–step reactions:4–bromo aniline,3-Nitroaniline, Sulphanilamide,4-Amino benzoicacid,4–Nitro benzoic acid, di halo benzenes, Nitro halo benzenes.<br>2. Industrial analysis of common raw materials as per industrial specification: Phenol, Aniline, Formaldehyde, Hydrogen peroxide, Acetone, Epoxide, Olefins, oils etc.<br>3. Demonstration of various pharmaceutical packaging materials, quality control tests of some materials,-A1 Strips, Cartons, Glass bottles<br>4. Limit tests for chlorine, heavy metals, arsenic etc. of two representative bulk drug.<br>5. Active ingredient analysis of few types of formulations representing different methods of analysis -acidimetry, alkalimetry, non-aqueous.<br>6. Determination of sulphate ash, loss of drying & othertestsofbulkdrugs,completeIPmonographofthreedrugs representingvariety of testing<br>7. Evaluation of crude drugs - macroscopic examination, determination &identification of starch granules, calcium oxalate | **30** |
| *Keywords* | ***Synthesis of organic compound, Crude test, Limit test, Pharmaceutical Packaging.*** | |

***Signature of Convener & Members (CBoS):***

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Vasudevan, T.N. (2006). Practical Pharmacognosy. New Delhi, India: Vallabh Prakashan.*

***Reference Books Recommended –***

1. *Wills, T.B. (2008). Practical Pharmacognosy. London, England: CBS Publishers & Distributors Pvt Ltd.*
2. *Vogel, A.I. (2000). Vogel's Textbook of Quantitative Chemical Analysis. Harlow, England: Pearson Education Limited.*
3. *Mann, A.K. (2007). Practical Organic Chemistry. New Delhi, India: Orient Blackswan.*

**Online Resources–**

- **https://www.sciencedirect.com/topics/engineering/raw-material-preparation**
- **https://www.ncbi.nlm.nih.gov/books/NBK92218/**
- **https://www.jiwaji.edu/pdf/ecourse/pharmaceutical/Evaluation%20of%20crude%20drugs.pdf**

## PART-D:Assessment and Evaluation

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

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

***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** *(Degree/Honors)* | | | **Semester VI** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSC-06T** | | |
| 2 | **CourseTitle** | **PHARMACEUTICALS** | | |
| 3 | **CourseType** | **DSC** | | |
| 4 | **Pre-requisite(if,any)** | *As per program* | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ **To correlate and compare the historical background/development of Indian and other important pharmacopoeias, and also an understanding of procedures in pharmaceuticals.**<br>➢ **To describe the manufacture and quality specifications of pharmaceutical excipients/additives, and gain an understanding of the applications of sutures, ligatures, and surgical dressings.**<br>➢ **To acquaint students with packaging/ancillary materials, machinery, and important legal aspects of the food and drug industry.**<br>➢ **To explain and compare the various statistical tools and testing methods employed for pharmaceutical quality control.** | | |
| 6 | **CreditValue** | **3 Credits** | *Credit = 15 Hours -learning & Observation* | |
| 7 | **TotalMarks** | **Max.Marks: 100** | | **Min Passing Marks:40** |

| **PART -B: Content oftheCourse** | | |
|---|---|---|
| **TotalNo.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)** | | |
| **Unit** | **Topics(Coursecontents)** | **No.ofPeriod** |
| **I** | Historicalbackground&development ofpharmaceutical industryinIndia in brief.Pharmacopoeias-DevelopmentofIndianpharmacopoeia& introduction fB.P.,U.S.P., E.P., N.F&other important Pharmacopoeias. Introductiontovarioustypesofformulations&routesofadministration.Asepticconditions,need forsterilization,variousmethodsofsterilization. | **12** |
| **II** | Various types of pharmaceutical excipients, their chemistry, process of manufacture & quality specifications. Glidants, lubricants, diluents, preservatives, antioxidants, emulsifying agents, coating agents, binders, coloring agents, flavouring agents, gelatin and other additives, sorbitol, mannitol, viscosity builders etc. Surgical dressing, sutures, ligatures with respect to the process, equipment used for manufacture, method of sterilization and quality control. | **11** |
| **III** | Pharmaceutical packaging introduction, package selection, packaging materials, ancillary materials, packaging machinery, quality control of packaging materials. F.D.A. Important schedules & some legal aspects of drugs. Pharmaceutical quality control (other than analytical methods covered under core subject) sterility testing, pyrogenic testing, glass testing, bulk density of powders etc. | **11** |
| **IV** | Evaluation of crude drugs - Moisture content, extractive value, volatile oil content, foreign organic matter, quantitative microscopic exercises, including starch, leaf content (palisade ratio, stomatal number & index, vein, islet number & vein | **11** |

| | | |
|---|---|---|
| | termination number), crude fiber content, introduction to chromatographic method for identification of crude drugs. Chromatography: Paper chromatography, TLC, HPLC, GLC. Ion chromatography | |
| *Keywords* | ***Pharmacopoeias, Formulations, Excipients, Sterilization, Packaging, Testing, Chromatography, HPLC,TLC.*** | |

***SignatureofConvener&Members (CBoS):***

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Mehrotra, K.N. (2005). Handbook of Drugs and Cosmetic Act. PharmaMed Press.*

***Reference Books Recommended –***

1. *Remstad, J.P. (1996). Modern Pharmacognosy. McGraw Hill.*
2. *Indian Pharmacopoeia (1985). Government of India, Ministry of Health and Family Welfare.*
3. *British Pharmacopoeia (1990). Her Majesty's Stationery Office.*
4. *Pharmaceutical Dosage Forms (2008). Lippincott Williams & Wilkins.*

**Online Resources:**

- https://igmpi.ac.in/IGMPIcampaign/Adword.php?gad_source=1&gclid=Cj0KCQjwgJyy-BhCGARIsAK8LVLMgtVOcIgWqnEjZ4SAUFYBfoY4nDDOTl_JwT0iVAkjhH85hZYjsHkaAoRHEALw_wcB
- https://www.slideshare.net/slideshow/different-techniques-of-pharmaceutical-analysis-239579341/239579341
- https://pubmed.ncbi.nlm.nih.gov/36179505/

## PART-D:Assessment andEvaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 100 Marks**
**ContinuousInternal Assessment(CIA):30 Marks**
**EndSemesterExam(ESE):70 Marks**

| | | |
|---|---|---|
| **Continuous InternalAssessment (CIA): (By Course Teacher)** | Internal Test / Quiz-(2): **20 +20**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Degree/Honors)* | | | **Semester-VI** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSC-06P** | | |
| 2 | **CourseTitle** | **INDUSTRIAL CHEMISTRY LAB. COURSE-VI** | | |
| 3 | **CourseType** | **DSC** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ To learn techniques for analyzing plant materials, conducting microbiological testing of drugs,<br>➢ To estimate drug concentration using spectrophotometry.<br>➢ To gain hands-on experience formulating pharmaceutical dosage forms<br>➢ To analyze fats, oils, and jewelry for their respective properties and composition. | | |
| 6 | **CreditValue** | **1 Credits** | ***Credit =30 Hours Laboratory or Field learning/Training*** | |
| 7 | **TotalMarks** | **Max.Marks:50** | **Min Passing Marks:20** | |

| **PART -B: Content oftheCourse** | | |
|---|---|---|
| **Total No. of learning-Training/performancePeriods:30 Periods (30 Hours)** | | |
| **Module** | **Topics(Coursecontents)** | **No. of Period** |
| **Lab./Field Training/ Experiment Contents of Course** | 1. Palisade ratio, stomatal index - determination and identification of few drugs, TLC method for identification.<br>2. Microbiological testing - determination of MIC of some antibacterial drugs by zone/cup plate method.<br>3. Spectrophotometric estimation of drugs – ciprofloxacin, paracetamol, etc.<br>4. Preparation of pharmaceutical formulations like cream, suspension, and emulsions.<br>5. Determination of saponification value of oil/polymeric materials.<br>6. Determination of iodine value of oil/polymeric materials.<br>7. Quantitative analysis of jewelry.<br>8. Determination of ash content in polymeric substance. | **30** |
| ***Keywords*** | ***Stomatal Index, Microbial testing, estimation, spectrometry, Saponification, cup-plate method, iodine value, ash content*** | |

*Signature of Convener & Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Vasudevan, T.N. (2006). Practical Pharmacognosy. Vallabh Prakashan.*
2. *Birajdar Arunadevi S. (2018). Basic Principles of Chromatography and HPLC. Springer*

***Reference Books Recommended –***

1. *Wills, T.B. (1987). Practical Pharmacognosy. CBS Publishers & Distributors.*
2. *Vogel, A.I., et al. (1989). Vogel's Textbook of Quantitative Chemical Analysis. Longman Scientific & Technical.*

**Online Resources–**

- **https://jru.edu.in/studentcorner/lab-manual/dpharm/1st-year/Pharmaceutics.pdf**
- **https://link.springer.com/book/10.1007/978-3-031-20298-8**
- **https://www.newhaven.edu/ resources/documents/academics/surf/past-projects/2013/kasey-cargill-paper.pdf**
- **https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/iodine-value#:~:text=It%20is%20defined%20as%20the,and%20all%20results%20are%20summed.**

## PART-D:Assessment andEvaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 50 Marks**
**ContinuousInternal Assessment(CIA):15 Marks**
**EndSemesterExam(ESE):35Marks**

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

***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** *(Honors/Honors with Research)* | | | **Semester -VII** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSC-07T** | | |
| 2 | **CourseTitle** | **ENVIRONMENTAL POLLUTION ANALYSIS** | | |
| 3 | **CourseType** | **DSC** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To Determine the air pollutants*<br>➢ *To learn physical, chemical and biological water quality parameters*<br>➢ *To analyses the soil composition*<br>➢ *To determine the heavy metals.* | | |
| 6 | **CreditValue** | **3 Credits** | ***Credit = 15 Hours -learning & Observation*** | |
| 7 | **TotalMarks** | **Max.Marks: 100** | | **Min Passing Marks:40** |

## PART -B: Content oftheCourse

**TotalNo.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)**

| Unit | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| I | **Air pollutants:** CO, $CO_2$, ozone, CFC, & NOx, ozone depletion, global warming Harmful effects of pollutants on living and non-living species, Analytical methods fo monitoring air pollutants, international and national standards. | 12 |
| II | **Physical, chemical and biological water quality parameters**; their assessment; Water pollution; water pollutants; toxicity aspects; international and national standards; control; Water sampling techniques; Water treatment processes: aeration, solid purification, nanofiltration, chemical treatments, reverses osmosis, desalination. Waste water treatment processes. Water table maintenance & harvesting methods. | 11 |
| III | **Composition of soil**: inorganic and organic components, micro and macronutrients; Soil pollution; Fertilizers, insecticides, pesticides, plastics, toxic metals, dyes, surfactants; toxicity aspects; international and national standards; control. | 11 |
| IV | **Heavy metal in the environment**; Sources of heavy metals; Poisoning of heavy metals in every bite; Mercury, Copper, Chromium, Cadmium, Cobalt, Lead, Arsenic.<br>**Industrial waste**; toxic aspects, management and disposal; Radioactive, municipal, agricultural and biomedical waste – toxicity hazards. Bhopal gas tragedy, Chernobyl disaster. | 11 |
| *Keywords* | ***Gaseous Pollutants, Analytical Methods, Water Quality Parameters, Composition, Environment, Heavy Metals, Industrial Waste*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Jain, S.K. (2012). Chemical Kinetics. Vishal Publication.*
2. *Sharma, B.K. (2005). Industrial Analysis. Gael Publication.*
3. *Shah, R.K., Vora, J.C., Vora, K.P., & Shah, R.S. (2015). Principles of Analytical Chemistry: Elsevier.*

***Reference Books Recommended –***

1. *Smith, J.M. (1981). Chemical Engineering Kinetics. McGraw Hill Book Co.*
2. *Parsania, P.H. (2011). Physico-Chemical Exercise: Nirali Prakashan.*

**Online Resources–**

- **https://swayam.gov.in/course/11228-air-water-and-soil-pollution**
- **https://nptel.ac.in/courses/105/105/105105176/**
- **http://cpcb.nic.in/**
- **https://www.neeri.res.in/**
- **https://www.epa.gov/**
- **https://www.who.int/airpollution/en/**

**Online Resources–**

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

## PART-D:Assessment andEvaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 100 Marks**
**ContinuousInternal Assessment(CIA):30 Marks**
**EndSemesterExam(ESE):70 Marks**

| | | |
|---|---|---|
| **Continuous InternalAssessment (CIA): (By Course Teacher)** | Internal Test / Quiz-(2): **20 ~~+~~20**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Honors/Honors with Research)* | | | **Semester - VII** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSC-07P** | | |
| 2 | **Course Title** | **INDUSTRIAL CHEEM. LAB. COURSE-VII** | | |
| 3 | **Course Type** | **DSC** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To determine the air pollutants.*<br>➢ *To determine the heavy metals contaminants in water and soil.*<br>➢ *To analyze techniques of removal of heavy metals from hazardous waste*<br>➢ *To learn colorimetric method and Winkler methods.* | | |
| 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 oftheCourse

**TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)**

| Module | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course** | 1. Determination of Henry's Law Constants.<br>2. Determination of an Ion Balance for a Water Sample.<br>3. Measuring the Concentration of Chlorinated Pesticides in Water Samples<br>4. Determination of nitrite in a water sample by colorimetric method.<br>5. Precipitation of Metals from Hazardous Waste<br>6. Determination of Dissolved Oxygen in Water Using the Winkler Method | **30** |
| ***Keywords*** | ***Water Sample, Heavy Metals, Determination, Colorimetric method, Analytical Methods*** | |

*Signature of Convener & Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Ahluwalia, V. K., and Sharma, R. (2010). Comprehensive Practical Organic Chemistry. Universities Press.*

***Reference Books Recommended-***

1. *Svehla, G. (1979). Inorganic Qualitative Analysis. Vogel.*
2. *Svehla, G. (1989). Organic Preparation. Vogel.*
3. *Mann, J. B., and Saunders, B. C. (1949). Organic Qualitative Analysis. Longmans, Green and Co.*

**Online Resources–**

- **https://www.epa.gov/sites/production/files/2015-05/documents/henryslawconstant_table.pdf**
- **https://www.epa.gov/sites/production/files/2015-05/documents/ionbalance_table.pdf**
- **https://www.epa.gov/sites/production/files/2021-05/documents/sw-846-update-vi-2019_edition_method-8081b.pdf**
- **https://www.epa.gov/sites/production/files/2015-07/documents/astm_d3867-04.pdf**
- **https://www.epa.gov/sites/production/files/2015-05/documents/precipitation_table.pdf**
- **https://www.epa.gov/sites/production/files/2015-05/documents/winkler_table.pdf**

**Online Resources–**

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

## PART-D:Assessment andEvaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 50 Marks**
**ContinuousInternal Assessment(CIA):15 Marks**
**EndSemesterExam(ESE):35Marks**

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

***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** *(Honors/Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSC-08T** | | |
| 2 | **CourseTitle** | **PETROCHEMICALS AND POLYMERS** | | |
| 3 | **CourseType** | **DSC** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *Demonstrate knowledge of production methods for specific hydrocarbon derivatives, as well as aromatic hydrocarbons.*<br>➢ *Apply the concept of synthesis gas production to understand the generation of key petrochemicals*<br>➢ *Describe the manufacturing processes for important polymers*<br>➢ *Explain the manufacturing processes for various synthesis resins used in different applications* | | |
| 6 | **CreditValue** | **3 Credits** | *Credit = 15 Hours -learning & Observation* | |
| 7 | **TotalMarks** | **Max.Marks: 100** | | **Min Passing Marks:40** |

## PART -B: Content oftheCourse

**TotalNo.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)**

| Unit | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| I | Production of Specific Hydrocarbon Derivatives with special emphasis on:<br>- C1 Compound.<br>- C2 Compound.<br>- C3 Compound.<br>- C4 Compound.<br>- Aromatic hydrocarbons. | 12 |
| II | **Production of Petrochemicals**:-<br>- Synthesis Gas, Acetylene, Butylene, Isopropanol, Phenol-Acetone, Hydrogen | 11 |
| III | **Manufacturing of Important Polymers**:- - Polyolefin, Vinyl, Acrylies, Polyamides, Polyesters, Polyurethanes, Polycarbonates, Current and Future Industrial Scope in India for Petrochemical and Polymer Industries. | 11 |
| IV | **Manufacturing of Synthesis Resins**:- - Alkyd resins. - Phenolic resins. - Amino resins. - Epoxy resins. - Unsaturated Polyesters. Building Block for Petrochemicals, Their separation and purification, manufacturing process of Aromatic and Napthhenes. | 11 |
| *Keywords* | ***Hydrocarbons, Petrochemicals, Polymers, Resins, Manufacturing Process, Separation and purification*** | |

*Signature of Convener & Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Jain, S. K. (2013). Chemical Kinetics. Vishal Publication.*
2. *Sharma, B. K. (2019). Industrial Analysis. Gael Publication.*
3. *Sharma, B. K. (2010). Hydrocarbons and petrochemicals (2nd ed.). Khanna Publishers.*
4. *Chakraborti, A. K. (2017). Polymer science. New Age International Publishers.*
5. *Srivastava, P. C. (2008). Resins: Chemistry, applications and technology. Studium Press.*

***Reference Books Recommended –***

1. *Perry, R. H. (Editor). (2018). Perry's chemical engineers' handbook (9th ed.). McGraw-Hill Education. (This is a classic reference by an international author, but highly relevant for the given topics)*
2. *Sharma, B. K. (2017). Industrial chemistry (2nd ed.). Khanna Publishers. (This book by an Indian author covers a broad range of industrial processes, including those relevant to your query)*
3. *Bhagat, S. D. (2012). A handbook of separation processes and techniques (2nd ed.). Academic Press.*
6. *Smith, J. M. (1981). Chemical engineering kinetics. McGraw Hill Book Co.*
4. *Parsania, P. H. (2006). Physico-chemical exercise.*

**Online Resources–**

- https://www.sciencedirect.com/topics/chemistry/hydrocarbon-derivatives
- https://www.chemguide.co.uk/organicprops/aromaticity/derivatives.html
- https://www.eolss.net/Sample-Chapters/C12/E6-76-02-01.pdf
- https://www.sciencedirect.com/topics/engineering/petrochemical-production
- https://www.chemeurope.com/en/encyclopedia/Petrochemicals.html
- https://www.sciencedirect.com/topics/chemistry/polymer-manufacturing
- https://www.researchgate.net/publication/337797150_Indian_Petrochemical_and_Polymer_Industry_An_Overview
- https://www.sciencedirect.com/topics/materials-science/alkyd-resin

**Online Resources–**

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

## PART-D:Assessment andEvaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 100 Marks**
**ContinuousInternal Assessment(CIA):30 Marks**
**EndSemesterExam(ESE):70 Marks**

| | | |
|---|---|---|
| **Continuous InternalAssessment(CIA): (By Course Teacher)** | Internal Test / Quiz-(2): **20 +20**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Honors/Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSC-08P** | | |
| 2 | **CourseTitle** | **INDUSTRIAL CHEM. LAB. COURSE-VIII** | | |
| 3 | **CourseType** | **DSC** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ **To understand concept of crystalline and amorphous state of polymers.**<br>➢ **To correlate flexibility with the glass transition temperature.**<br>➢ **To understand structure-property relationship of polymers.**<br>➢ **To apply mathematical formulae to depict polymer solution properties**<br>➢ **To apply the knowledge of latex manufacturing and compounding.**<br>➢ **To apply the knowledge of techniques used in monomer production** | | |
| 6 | **CreditValue** | **1 Credits** | ***Credit =30 Hours Laboratory or Field learning/Training*** | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

## PART -B: Content of the Course

**TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)**

| Module | Topics(Course contents) | No.ofPeriod |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course** | 1. Chemical identification of polymers- • Unsaturation • Testing of functiona groups (associated with polymers).<br>2. To determine the melting point of crystalline polymers.<br>3. To check the solubility of the given polymeric sample in different solvents.<br>4. Determination of molecular weight by solution viscosity.<br>5. Fractional distillation of crude oil.<br>6. To calculate dry rubber content (DRC) of latex.<br>7. To determine the coagulation strength of latex. | **30** |
| ***Keywords*** | ***Petrochemicals, Polymers, Functional group, Viscosity, Solution*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Gowarikar V.R., (2010) Polymer Science, New Age International Publishers Ltd.*
2. *Shah V., (1998) Handbook of Plastics Testing Technology, Wiley Interscience.*
3. *Kumar D., Chandra R., (2001) Latex Technology, DhanpatRai& Co.*
4. *Rao B.K.B., (2007) Text book on Petrochemicals, Khanna Publishers.*

***Reference Books Recommended –***

1. *Brydson J.A., (1999) Plastics Materials, Butterworth Heinemann.*
2. *Billmeyer F.W., (2007) Textbook of Polymer Science, Wiley, India.*

**Online Resources–**

- **https://www.sciencedirect.com/topics/chemistry/hydrocarbon-derivatives**
- **https://www.chemguide.co.uk/organicprops/aromaticity/derivatives.html**
- **https://www.eolss.net/Sample-Chapters/C12/E6-76-02-01.pdf**
- **https://www.sciencedirect.com/topics/engineering/petrochemical-production**
- **https://www.sciencedirect.com/topics/chemistry/polymer-manufacturing**
- **https://www.sciencedirect.com/topics/materials-science/alkyd-resin**

**Online Resources–**

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

## PART-D: Assessment and Evaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 50 Marks**
**Continuous Internal Assessment(CIA):15 Marks**
**End Semester Exam (ESE): 35Marks**

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

***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** *(Diploma / Degree/Honors)* | | | **Semester - III** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-01T** | | |
| 2 | **Course Title** | **FOOD CHEMISTRY** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *Understanding the basics of cereals and sugars and their related products.*<br>➢ *Role of vegetables, fungi, and algae in food chemistry.*<br>➢ *Understanding the role and mechanism of action of beverages and appetizers.*<br>➢ *Applications of preservatives, additives, and packaging in food industry.* | | |
| 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 | **Cereals and Sugar**<br>Cereals definition - Classification, Processing - Structure of Cereals - Composition an nutritive value. Pulses definition - Classification - Processing - Structure of Pulses Composition and nutritive value - Toxic Constituents in pulses - medicinal value o cereals and pulses.<br>**Sugar and related products**. Sugar Structure and Properties. Nutritive value - Suga composition in different food items. Sugar related product - Classification & nutritiv value. Artificial sweeteners - example - advantages and disadvantages. | 11 |
| II | **Vegetables, Fungi, and Algae**<br>**Vegetables** - classification - composition & nutritive values - Fruits- Classification - Composition & nutritive values.<br>**Fungi and algae as food** - enzymatic browning and non-enzymatic browning - Nutritive value of some common foods - milk, egg., soyabeans. | 11 |
| III | **Beverages and Appetizers:**<br>**Beverages** - definition and examples - Classification of beverages<br>Fruit beverages - Milk based beverages - malted beverages - examples.<br>Alcoholic and non-alcoholic beverages - examples.<br>**Appetizers** - definition - classification - examples - Water - functions and deficiency. | 11 |
| IV | **Food preservatives, additives, and packaging:**<br>**Food Preservatives** - definition - classification - Food Spoilage - definition - Prevention.<br>**Methods of preservation** - classification - Low and high temperature - preservatives examples - Dehydration - osmotic pressure - food irradiation.<br>**Food additives**-Definition-classification-their functions- chemical substance.<br>**Packaging of foods**-classification-Materials used for packaging. | 12 |
| *Keywords* | ***Food, chemistry, cereals, sugar, beverages, appetizers, preservatives, packaging.*** | |

*Signature of Convener & Members (CBoS):*

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Srilakshmi, B. (2003). Food science. New Age International.*
2. *Swaminathan, D. M. (2013). Handbook of food and nutrition. The Bangalore Printing & Publishing Co. Ltd.*

***Reference Books Recommended –***

1. *Meyer, L. H. (2015). Food chemistry.*
2. *Mudambi, S. R. (2001). Fundamentals of foods and nutrition. New Age International.*

**Online Resources–**

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

- **https://ccsuniversity.ac.in/bridge-library/pdf/FST-Paper-%20II%20Food%20Beverages-%20IV-Semester.pdf**
- **http://ecoursesonline.iasri.res.in/mod/page/view.php?id=90258**
- **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8464797/**
- **http://www.uprtou.ac.in/other_pdf/dvapfv_block_3.pdf**

**Online Resources–**

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

## PART-D:Assessment andEvaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 100 Marks**
**ContinuousInternal Assessment(CIA):30 Marks**
**EndSemesterExam(ESE):70 Marks**

| | | |
|---|---|---|
| **Continuous InternalAssessment (CIA): (By Course Teacher)** | Internal Test / Quiz-(2): **20** ~~**40**~~ **20**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>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** *( Diploma / Degree/Honors)* | | **Semester - III** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSE-01P** | |
| 2 | **CourseTitle** | **FOOD CHEMISTRY LAB. COURSE** | |
| 3 | **CourseType** | **DSE** | |
| 4 | **Pre-requisite**(if,any) | *As per program* | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To find out moisture content in food samples.*<br>➢ *To find out ash, crude protein, crude fat, total carbohydrate, crude fibre in food samples.*<br>➢ *To determine pH, acidity, vitamin, and sugars in food samples.*<br>➢ *To identify pigments, Saccharine, and nutritional deficiency disorders.* | |
| 6 | **CreditValue** | **1 Credits** | *Credit =30 Hours Laboratory or Field learning/Training* |
| 7 | **TotalMarks** | **Max.Marks:50** | **Min Passing Marks:20** |

**PART -B: Content of theCourse**

**TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)**

| Module | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course** | • To find out the moisture content from a given food sample by lab oven method.<br>• To find out the moisture content from a given sample by using moisture meter.<br>• To find out the ash in the given food sample.<br>• To find out the acid insoluble ash from a given food sample.<br>• To find out the amount of crude protein in a given food sample.<br>• Experiment- Crude Protein- Protein by Kjeltec.<br>• To find out the amount of crude fat in a given food sample.<br>• To find out the amount of total carbohydrates in a given food sample.<br>• To find out the amount of crude fiber in a given food sample.<br>• To determine the pH of a given sample using pH paper and Universal Indicator.<br>• To determine the pH of a given sample using pH Meter<br>• Determination of acidity of given honey sample.<br>• To determine the acidity of extracted fat in a given sample of biscuit.<br>• To determine the reducing and non- reducing sugars in a given food sample.<br>• To determine the Vitamin- C (Ascorbic Acid) in a given food sample.<br>• To determine the Diastase enzyme (α- amylase) activity in a given food sampl by Falling Number test.<br>• To identify different pigments, present in a given food sample by pape chromatography.<br>• To observe the effect of baking soda in CO2 production.<br>• To test the presence of Saccharine in the given sample of beverage.<br>• To know about various nutritional deficiency disorders.<br>• Reports/Projects conductance on food chemistry. | **30** |
| *Keywords* | ***Food, chemistry, moisture, Protein, vitamin, carbohydrate, fat, ash, pH meter, crude, fiber, pH meter, nutrition.*** | |

*Signature of Convener & Members (CBoS):*

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Shukla, S., & Bedi, G. S. (2015).* Food analysis laboratory manual *(2nd ed.). New Age International (Publishers).*
2. *Desai, B. S. (2010).* Experimental food science *(3rd ed.). Viva Books Private Limited.*

***Reference Books Recommended –***

1. *Caballero, B., Finglas, P., & Toldrá, F. (2015). Encyclopedia of food and health. San Diego, CA: Academic Press.*
2. *Nielsen, S. S. (2017). Introduction to food analysis. In Food analysis (pp. 3-16). New York, NY: Springer.*
3. *Parimelazhagan, T., & Thangaraj, P. (2016). Proximate composition analysis. In Pharmacological assays of plant-based natural products (pp. 21-31).*
4. *BeMiller, J. N. (2017). Carbohydrate analysis. In Food analysis (pp. 333-360). New York, NY: Springer.*

**Online Resources–**

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

- **https://gpadampur.files.wordpress.com/2015/08/3-2-fcn-practical.pdf**
  **http://sihfwup.in/content/assets/pdf/CME/Nutritional_Deficiency_Disease_Book.pdf**
- **https://onlinecourses.swayam2.ac.in/cec20_ag10/preview**
- **https://onlinecourses.nptel.ac.in/noc23_ag19/preview**
- **https://archive.nptel.ac.in/courses/103/107/103107088/**

**Online Resources–**

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

## PART-D: Assessment and Evaluation

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

| | | |
|---|---|---|
| **Continuous Internal Assessment(CIA):** **(By Course Teacher)** | Internal Test / Quiz-(2): **10 &10**<br>Assignment/Seminar +Attendance- **05**<br>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**<br>**A. Performed the Task based on lab. work - 20 Marks**<br>**B. Spotting based on tools& technology (written) – 10 Marks**<br>**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:***

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# DEPARTMENT OF INDUSTRIAL CHEMISTRY
## COURSE CURRICULUM

| **PART-A: Introduction** | | | | |
|---|---|---|---|---|
| **Program: Bachelor in Science** *(Diploma / Degree/Honors)* | | | **Semester - IV** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-02T** | | |
| 2 | **Course Title** | **ENVIRONMENTAL REMEDIATION** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ ***Understand pollutants, their statutory limits and air pollution as well as water pollution.***<br>➢ ***Acquire knowledge and handling of pesticide, gaseous, and solod waste pollution.***<br>➢ ***Gain knowledge about soil economics and project handling.***<br>➢ ***Acquire knowledge and handling technology and quality control.*** | | |
| 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** | **Pollutants and their statutory limits:**<br>Definition and classification of pollutants, primary and secondary pollutants, Pollution evaluation methods.<br>**Air Pollution:**<br>Sources and classification of air pollution, major air pollutants and theirhealth impacts, phenomenon of acid rain, photo chemical smog and ozone depletion, composition of fly-ash, pollution control equipment/techniques.<br>**Water pollution:**<br>Types of water pollution, organic and inorganic pollutants, point and nonpoint sources of water pollution, estimation of chlorine in water, measurement of BOD & COD, techniques for removal of waste from water. | **12** |
| **II** | **Pesticide pollution:**<br>Classification of chemical pesticides, examples of organochlorines and organophosphates, persistent organic pollutants (POPs) and their half-lives, environmental effects of pesticides, soil and water contamination and its impact, bioaccumulation of pesticides and pesticide contamination in food.<br>**Solid & gaseous wastes:**<br>Removal of solid contaminants of wastes- coagulation, sedimentation, flocculation, solid wastedisposal, incineration, fuel pelletization, soil conditioning Adsorption, catalytic/non catalytic conversion, recovery of important gases, $CO_2$, $SO_2$, NO etc. electrostatic precipitation and bag filters. | **11** |
| **III** | **Soil economics A**: Factors involved in project cost estimation; methods employed for the estimation of capital investment, capital formation, elements of cost accounting, interest and investment costs, time value of money equivalence.<br>**Soil economics B**:Methods of determining depreciation, some aspects of marketing, pricing policy, profitability criteria, economics of selecting alternatives, variation of cost with capacity, break-even point, optimum batch sizes, production scheduling etc. | **11** |
| **IV** | **Soil economics C:** Need, scope and characteristics of entrepreneurship, special schemes | **11** |

| | | |
|---|---|---|
| | for technical entrepreneurs' development (STED), exposure to demand based, resource based, service based, import substitute and export promotion industries, criteria for principles of products selection and development.<br>**Choice of technology and quality control:**<br>Plant and equipment's, techno-economic feasibility of the projects, plant layout and process planning for the project. Quality control, quality assurance and testing of the product, packaging, advertising and aftersales service. | |
| *Keywords* | ***Pollution, air, water, soil, pesticides, solid, gaseous, wastes, economics, technology quality control.*** | |

***Signature of Convener & Members (CBoS)s:***

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. Trivedy, R. K., & Raman, N. S. (2002). *Industrial Pollution and Environmental Management*. Scientific Publishers.
2. Rathore, H. S., & Nollet, L. M. (Eds.). (2012). *Pesticides: Evaluation Of Environmental Pollution*. CRC Press.
3. De, A. K. (2003). Environmental Chemistry. New Delhi: New Age International.

***Reference Books Recommended –***

1. *Brusseau, M. L., Pepper, I. L., & Gerba, C. P. (2019). The Extent Of Global Pollution. In Environmental And Pollution Science (Pp. 3-8). Academic Press.*
2. *Rad, P. F. (2001). Project Estimating and Cost Management. Berrett-Koehler Publishers.*

**Online Resources–**

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

- https://nptel.ac.in/courses/126105016
- https://nptel.ac.in/courses/105103205
- https://nptel.ac.in/courses/126105010
- https://nptel.ac.in/courses/105/102/105102089/
- https://nptel.ac.in/courses/122/106/122106030/
- https://nptel.ac.in/content/storage2/courses/120108004/module1/lecture1.pdf

**Online Resources–**

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

## PART-D:Assessment andEvaluation

**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~~**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***Name and Signature of Convener & Members of CBoS:***

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

| **PART-A: Introduction** | | | | |
|---|---|---|---|---|
| **Program:Bachelor in Science** *(Diploma / Degree/Honors)* | | | **Semester - IV** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSE-02P** | | |
| 2 | **CourseTitle** | **ENVIRONMENTAL REMEDIATION LAB COURSE** | | |
| 3 | **CourseType** | **DSE** | | |
| 4 | **Pre-requisite**(if,any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To know the basic idea on techniques of water analysis and acidity alkalinity.*<br>➢ *To get experience with the calculations of BOD and COD*<br>➢ *To Understand the basics of soil analysis viz. pH, Conductivity.*<br>➢ *To have an experience on the determination of heavy metals in soil.* | | |
| 6 | **CreditValue** | **1 Credits** | *Credit =30 Hours Laboratory or Field learning/Training* | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

## PART -B: Content of theCourse

**TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)**

| Module | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course** | • Determination of acidity and alkalinity of water samples.<br>• Determination of temporary, permanent, and total hardness of water.<br>• Determination of chloride, sulphate, nitrite, and phosphates in water samples.<br>• Determination of D.O, BOD, and COD.<br>• Determination of pH of soil samples.<br>• Determination of conductivity of soil samples.<br>• Determination of metal (Ca & Mg).<br>• Determination of heavy metals like Cd, Pb, Cr, Zn.<br>• Report on soil economics.<br>• Project/survey on environmental management/technologies, and quality control.. | **30** |
| *Keywords* | ***Water, acidity, alkalinity, water hardness, D.O., BOD, COD, metals, pH, economics, technology, water quality.*** | |

***SignatureofConvener&Members (CBoS):***

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Birdie, G. S. (2020).* Water supply and sanitary engineering *(10th ed.). Dhanpat Rai Publishing Company.*
2. *Biswas, T. D., & Mukherjee, T. K. (2008).* A textbook of soil science *(2nd ed.). Tata McGraw-Hill Education.*
3. *Das, D. K. (2011).* Soil analysis in agricultural chemistry and environmental science. *Kalyani Publishers.*

***Reference Books Recommended-***

1. *Vogel, A. I. (1955). A text-book of quantitative inorganic analysis: theory and practice. Longmans, Green and Company.*
2. *Harrison, R. M. (Ed.). (2012). Handbook of air pollution analysis. Springer Science & Business Media.*
3. *Boubel, R. W., Vallero, D., Fox, D. L., Turner, B., & Stern, A. C. (2013). Fundamentals of air pollution. Elsevier.*

**Online Resources–**

- **e-Resources / e-books and e-learning portals**
- https://ncert.nic.in/textbook/pdf/kech207.pdf
- https://archive.nptel.ac.in/courses/122/106/122106030/
- https://www.ncbi.nlm.nih.gov/books/NBK83730/
- https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/18%3A_Chemistry_of_the_Environment
- https://byjus.com/chemistry/environmental-chemistry/
- https://www.envirotech-online.com/news/gas-analyser/157/envea/portable-multi-gas-analyser-gains-qal1-certification-for-so2/60799.

**Online Resources–**

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

## PART-D: Assessment andEvaluation

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

| | | |
|---|---|---|
| **Continuous Internal Assessment(CIA):** **(By Course Teacher)** | Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- 0 Total Marks **-15** 05 | 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**<br>**D. Performed the Task based on lab. work - 20 Marks**<br>**E. Spotting based on tools& technology (written) – 10 Marks**<br>**F. Viva-voce (based on principle/technology) - 05 Marks** | **Managed by Course teacher as per lab. status** |

***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** *( Degree/Honors)* | | | **Semester V** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-03T** | | |
| 2 | **Course Title** | **DATA ANALYSIS AND SEPARATION TECHNIQUES** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To learn the data analysis, significant figure and error.*<br>➢ *To learn Chromatographic separation techniques.*<br>➢ *To learn the purification technique of chemical compound.*<br>➢ *To learn the computer program useful in industrial chemistry* | | |
| 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 | Data analysis, theory of errors, idea of significant figures and its importance with examples, precision, accuracy, methods of expressing accuracy. Error analysis, minimizing errors, method of expressing precision, average deviation, standard deviation and confidence limit. | 12 |
| II | Purification of solid organic compounds : extraction, use of immiscible solvents, soxhlet extraction, crystallization, use of miscible solvents, fractional crystallization, sublimation. Purification of liquids, experimental techniques of distillation, fractional distillation, vacuum distillation, steam distillation, tests for purity. | 11 |
| III | Chromatography- principles and techniques of column, paper and thin layer chromatography-$R_f$ value- applications.<br>Ion exchange chromatography-principle-experimental techniques and applications.<br>HPLC and GC-Principle, instrumentation and applications<br>GC-MS and LC-MS-Principle, instrumentation and applications | 11 |
| IV | Introduction to computer and its application in chemistry – characteristics of a computer – types of computer – block diagram of a digital computer – the art of programming – general features of a programming language – algorithm and flow charts. Introduction to C, structure of a C program, character set of C data types , identifiers, reserved words, variables, constants, keywords, escape sequence, type conversion C operation (basic aspects only). Application of computer in chemistry, determination of molarity, normality and molality of solutions, calculation of pH. | 11 |
| *Keywords* | ***Accuracy, precession, mean deviation standard deviation, chromatography, Computer C-Programming, HPLC,GCMS.*** | |

*Signature of Convener & Members (CBoS):*

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Gopalan, R., Subramanian, P. S., & Rengarajan, K. (1997). Elements of analytical chemistry. New Delhi, India: S. Chand and Sons.*
2. *Chatwal, A. (2000). Instrumental methods of chemical analysis. New Delhi, India: Anand-Himalaya Publishing House.*
3. *Raman, K. V. (1993). Computers in chemistry. New Delhi, India: Tata McGraw-Hill Ltd.*
4. *Srivastava, V. K., & Srivastava, K. K. (1991). Introduction to chromatography. S. Chand and Sons.*

***Reference Books Recommended –***

1. *de la Vie, R. (1997). A spreadsheet workbook for quantitative chemical analysis. New Delhi, India: McGraw-Hill, Inc.*
2. *Leonard. J, Lygo. B & Procter, G. (2013). Advanced Organic Practical Chemistry, CRC Press.*
3. *Shobha, R., & Banani, M. (2017). Essentials of Analytical Chemistry. Pearson.*

**Online Resources–**

- https://www.khanacademy.org/math/statistics-probability
- https://www.nist.gov/document/glp-9-rounding-20190506docx
- https://www.physics.purdue.edu/academic-programs/lab-materials/Physics%20220%20lab%20files/experimental-errors-and-significant-figures.pdf
- https://www.masterorganicchemistry.com/

## 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 InternalAssessment (CIA): (By Course Teacher)** | Internal Test / Quiz-(2): **20 +20**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Degree/Honors)* | | | **Semester V** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSE-03P** | | |
| 2 | **CourseTitle** | **DATA ANALYSIS AND SEPARATION TECHNIQUES LAB COURSE** | | |
| 3 | **CourseType** | **DSE** | | |
| 4 | **Pre-requisite**(if,any) | *As per program* | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To learn the data analysis, significant figure and error.*<br>➢ *To learn Chromatographic separation techniques.*<br>➢ *To learn the purification technique of chemical compound.*<br>➢ *To learn the computer program useful in industrial chemistry.* | | |
| 6 | **CreditValue** | **1 Credits** | *Credit =30 Hours Laboratory or Field learning/Training* | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

## PART -B: Content of theCourse

**TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)**

| Module | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course** | **Gravimetric estimation**<br>**a.** Estimationofsulphateasbariumsulphate.<br>b. Estimationofbariumasbariumsulphate.<br>c. Estimationofbariumasbariumchromate.<br>d. Estimationofleadasleadchromate.<br>**Principles involved in chromatographic separation**:<br>Paper Chromatography, Column Chromatography TLC: Separation of following metal ions: (i)Ni(II), and Co(II), (ii)Fe(III) And Al(III).<br>Volumetric analysis:<br>(i)Determination of commercial vinegar in acetic acid.<br>(ii) Estimation of ferrous and ferric by dichromate method.<br>(iii)Estimation of Copper using thiosulphate.<br>**Programming** :making and running the program. | **30** |
| *Keywords* | ***Gravimetric estimation, Volumetric analysis, Chromatographic experiment paper and column, TLC, C-Programming.*** | |

*Signature of Convener &Members (CBoS):*

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. Singh, A. K., & Singh, A. K. (2009). *Computer "C" programming: Concepts, principles, and programs*
2. *Shobha, R., & Banani, M. (2017). Essentials of Analytical Chemistry. Pearson.*

***Reference Books Recommended –***

1. *Rattenbury, E. M. (1966). Introductory titrimetric and gravimetric analysis. Pergamon Press.*
2. *Vogel, A. I. (1976). A textbook of qualitative inorganic analysis (3rd ed.). Longman.*
3. *Scott, P. W. (Year). Techniques and practice of chromatography. Publisher (if available).*

**Online Resources:**

- https://www.nist.gov/video/gravimetric-and-volumetric-based-quantitation https://acsanalytical.org/
- https://www.khanacademy.org/science/hs-chemistry/x2613d8165d88df5e:stoichiometry-and-the-mole/x2613d8165d88df5e:mole-calculations/v/worked-example-calculating-molar-mass-and-number-of-moles
- https://www.britannica.com/science/chromatography
- https://edu.rsc.org/resources/chromatography/11333.article

## PART-D:Assessment andEvaluation

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

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

***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** *(Degree/Honors)* | | | **Semester VI** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-04T** | | |
| 2 | **Course Title** | **INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite**(if,any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To address the student about the inorganic materials which is important in industries.*<br>➢ *To understand the preparation, type and use of silicates.*<br>➢ *To understand the types of fertilizer as inorganic compound.*<br>➢ *To understand the alloy formation and batteries in industries.* | | |
| 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 | **Silicate Industries**<br>*Glass:* Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.<br>*Ceramics:* Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes, carbon nanotubes and carbon fibre. | 12 |
| II | **Fertilizers:**<br>Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate. | 11 |
| III | **Alloys**<br>Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels. | 11 |
| IV | **Batteries**<br>Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell. | 11 |
| *Keywords* | ***Silicates, fertilizers, Alloy Primary and secondary batteries, Fuel cell.*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Jain, P. C., & Jain, M. (2010. Engineering chemistry. Dhanpat Rai & Sons.*
2. *Gopalan, R., Venkappayya, D., & Nagarajan, S. (2016). Engineering chemistry. Vikas Publishing House Pvt Ltd.*
3. *Sharma, B. K. (2005). Engineering chemistry. Goel Publishing House.*

***Reference Books Recommended –***

1. *Stocchi, E. (Vol. 1). Industrial chemistry. Ellis Horwood Ltd.*
2. *Felder, R. M., & Rousseau, R. W. (2007). Elementary principles of chemical processes, Wiley.*
3. *Kingery, W. D., Bowen, H. K., & Uhlmann, D. R. (2008). Introduction to ceramics,Wiley India Pvt. Ltd.*
4. *Kent, J. A. (Ed.). (1993). Riegel's handbook of industrial chemistry. CBS Publishers & Distributors.*

**Online Resources:**

- https://www.usgs.gov/centers/national-minerals-information-center/silica-statistics-and-information -
- https://www.fertilizer.org/ https://www.asminternational.org/ -
- https://www.nrel.gov/ -
- https://www.energy.gov/batteries

## PART-D:Assessment andEvaluation

**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**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Degree/Honors)* | **Semester VI** | Session: **2024-2025** |
|---|---|---|

| | | | |
|---|---|---|---|
| 1 | **CourseCode** | **ICSE-04P** | |
| 2 | **CourseTitle** | **INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE LAB COURSE** | |
| 3 | **CourseType** | **DSE** | |
| 4 | **Pre-requisite**(if,any) | *As per program* | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To learn the analysis of components of fertilizers.*<br>➢ *To learn the analysis of alloy*<br>➢ *To perform the sample analysis of ore to find the metal percentage.*<br>➢ *To demonstrate the metallic coating on ceramics.* | |
| 6 | **CreditValue** | **1 Credits** | *Credit =30 Hours Laboratory or Field learning/Training* |
| 7 | **TotalMarks** | **Max.Marks:50** | **Min Passing Marks:20** |

**PART -B: Content of theCourse**

**TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)**

| Module | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course** | 1.Determination of free acidity in ammonium sulphate fertilizer.<br>2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.<br>3. Estimation of phosphoric acid in superphosphate fertilizer.<br>4. Electroless metallic coatings on ceramic and plastic material.<br>5. Determination of composition of dolomite (by complexometric titration).<br>6. Analysis of Cement.<br>7. Preparation of pigment (zinc oxide).<br>8. Determination of percentage of metal in alloy. | **30** |
| *Keywords* | ***Fertilizer, alloy, plastic, cement, zinc oxide .*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Sharma, S. K., & Sharma, R. K. (2018). Practical manual for fertilizer analysis. Directorate of Agricultural Research.*
2. *Sinha, S. K. (1972). A handbook of analysis of soil and plant products. Oxford & IBH Publishing Company.*
3. *Sparks, D. L. (1996). Physico-chemical and biological methods for soil analysis. Kluwer Academic Publishers.*

***Reference Books Recommended –***

1. *Stocchi, E. (Vol. 1). Industrial chemistry. Ellis Horwood Ltd.*
2. *Felder, R. M., & Rousseau, R. W. (2007). Elementary principles of chemical processes, Wiley.*
3. *Kingery, W. D., Bowen, H. K., & Uhlmann, D. R. (2008). Introduction to ceramics,Wiley India Pvt. Ltd.*
4. *Kent, J. A. (Ed.). (1993). Riegel's handbook of industrial chemistry. CBS Publishers & Distributors.*

**Online Resources–**

- https://echa.europa.eu/substance-information/-/substanceinfo/100.029.076
- https://pubs.acs.org/doi/abs/10.1021/acs.jchemed.2c00764
- https://www.sciencedirect.com/science/article/abs/pii/S0016706121002883
- : https://pubs.acs.org/doi/abs/10.1021/acs.jchemed.2c00764
- : https://www.astm.org/
- https://www.sciencedirect.com/science/article/abs/pii/S0272884218302165
- https://pubs.acs.org/doi/10.1021/acsreagents.2001

## PART-D:Assessment andEvaluation

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

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

***Name and Signature of Convener & Members of CBoS:***

# FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)

## DEPARTMENT OF INDUSTRIAL CHEMISTRY

## COURSE CURRICULUM-2024-28

| **PART-A: Introduction** | | | | |
|---|---|---|---|---|
| **Program: Bachelor in Science** *(Honors/Honors with Research)* | | | **Semester –VII** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSE-05T** | | |
| 2 | **CourseTitle** | **MODERN ANALYTICAL TECHNIQUES-I** | | |
| 3 | **CourseType** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ ***Understanding the principles behind various analytical techniques used in modern scientific research.***<br>➢ ***Familiarity with the instrumentation and equipment utilized in these techniques***<br>➢ ***Ability to critically analyze and interpret data obtained from these techniques***<br>➢ ***To learn chromatographic techniques for separation of organic compounds.*** | | |
| 6 | **Credit Value** | **3 Credits** | ***Credit = 15 Hours -learning & Observation*** | |
| 7 | **Total Marks** | **Max. Marks: 100** | **Min Passing Marks:40** | |

## PART -B: Content oftheCourse

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

| Unit | Topics(Course contents) | No.of Period |
|---|---|---|
| I | **Principles, Construction and working of the following measuring equipment's:** Temperature:- Glass Thermometer, Bimetallic thermometer, Pressure spring thermometer Vapour filled, thermometer, Resistance thermometer. Viscosity:- Capillary tub Viscometer, falling sphere viscometer, Rotating cylinder viscometer, viscosity sensitiv rotameter. Density & Specific gravity:-Pycnometer, Hydrometer, Specific gravity balance Liquid Level:- Direct & indirect liquid level methods. | **12** |
| II | **Colorimetry**:- General discussion, Theory of Colorimetry, Colorimetric methods and apparatus. pHmetry:- Measuring systems, Methods and apparatus. | **11** |
| III | **Analytical and testing instrumentation**:- Ultra-Violet and Visible Spectrometers, Infra-Red Spectrometers and analyzers, Mass Spectrometers, Conductimetry:- Measuring systems, Methods and apparatus. Potentiometry:- Measuring systems, Methods and apparatus. | **11** |
| IV | **Chromatographic Techniques:-** Gas chromatography, Liquid chromatography, Paper chromatography, Ion-exchange chromatography. | **11** |
| ***Keywords*** | ***Equipment's, Colorimetry, pH metry, Analytical, Chromatographic*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Jain, S. K. (2008). Chemical kinetics. Vishal Publication. Sharma,*
2. *B. K. (2017). Industrial analysis. Gael Publication.*
3. *Shah, R. K., Vora, J. C., Vora, K. P., & Shah, R. S. (2018). Principles of analytical chemistry.*

***References Books Recommended –***

1. *Smith, J. M. (1981). Chemical engineering kinetics. McGraw-Hill Book Co.*
2. *Parsania, P. H. (2014). Physico-chemical exercise*

**Online Resources–**

- **e-Resources / e-books and e-learning portals**
- **https://www.explainthatstuff.com/thermometers.html"**
- **https://www.miepl.com/technical-education-news-description/what-is-the-working-principle-of-bimetal-thermometer-/9167**
- **"https://m.youtube.com/shorts/BnAQWYFggC8**
- **https://m.youtube.com/watch?v=tnXFqGuD3VA**
- **https://www.youtube.com/watch?v=TSXS4FqzxAQ**
- **https://www.youtube.com/watch?v=8ZKKoknV9QU**
- **https://instrumentationtools.com/types-level-measurement/**
- **https://www.ssi.shimadzu.com/products/molecular-spectroscopy/uv-vis/index.html"**
- **https://m.youtube.com/watch?v=wxrAELeXlek**

**Online Resources–**

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

## PART-D: Assessment andEvaluation

**Suggested Continuous Evaluation Methods:**

**Maximum Marks: 100 Marks**

**Continuous Internal Assessment(CIA):30 Marks**

**End Semester Exam(ESE):70 Marks**

| | | |
|---|---|---|
| **Continuous InternalAssessment (CIA): (By Course Teacher)** | Internal Test / Quiz-(2): **20 /20**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Honors/Honors with Research)* | | | **Semester - VII** | Session: **2024-2025** |
| 1 | **CourseCode** | **CHSE-05P** | | |
| 2 | **CourseTitle** | **MODERN ANALYTICAL TECHNIQUES-I LAB. COURSE** | | |
| 3 | **CourseType** | **DSE** | | |
| 4 | **Pre-requisite**(if,any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ **Develop knowledge of mixture properties and analysis techniques.**<br>➢ **Differentiate between volumetric and gravimetric analysis.**<br>➢ **Understand conductometric and colorimetric analysis.**<br>➢ **Understand pH metric and potentiometric techniques.** | | |
| 6 | **CreditValue** | **1 Credits** | ***Credit =30 Hours Laboratory or Field learning/Training*** | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

| **PART -B: Content of theCourse** | | |
|---|---|---|
| **TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)** | | |
| **Module** | **Topics(Coursecontents)** | **No.ofPeriod** |
| **Lab./Field Training/ Experiment Contents of Course** | Paper chromatography for ion separation.<br>Colorimetric analysis for titration method.<br>Determination of sample by Conductometric, Colorimetric, pH metric an<br>Potentiometric method | **30** |
| ***Keywords*** | ***Chromatography, Volumetric, Gravimetric, Conductometric, pH Metric.*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. Chauhan, M. S. (2013). Analytical Chemistry: A Textbook of Principles and Instrumental Techniques. New Age International Publishers.
2. Sharma, T. R., & Gupta, S. K. (2016). Quantitative Analysis for Management. Kalyani Publishers.
3. Sharma, B. K. (2017). Instrumental Methods of Chemical Analysis. Goel Publishing House.
4. Srivastava, S. K., & Agarwal, R. (2014). Analytical Chemistry: Principles and Techniques. New Age International Publishers.
5. Yadav, M. S., & Yadav, P. (2016). Principles of Analytical Chemistry. S. Chand & Company Ltd.

***Reference Books Recommended –***

1. *Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of Instrumental Analysis. Cengage Learning.*
2. *Bassett, J., Denney, R. C., Jeffery, G. H., & Mendham, J. (1974). Vogel's Textbook of Qualitative Chemical Analysis (5th Ed.). ELBS.*
3.

**Online Resources–**

- **(https://www.chemguide.co.uk/analysis/index.html)**
- **(https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome)**
- **(https://www.youtube.com/playlist?list=PLy2022BX6EspFAK8Bf-TXMmTd8fqmFh_2)**
- **(https://www.chemistrylearner.com/analytical-chemistry-resources.html)**

**Online Resources–**

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

## PART-D: Assessment andEvaluation

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

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

***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** *(Honor/ Honors with Research)* | | | **Semester - VII** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-06T** | | |
| 2 | **Course Title** | **ORGANIC SYNTHESIS** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To apply stereochemical concepts to predict the outcomes of chemical reactions*<br>➢ *To understand the reaction mechanism of named reactions*<br>➢ *To understand the reaction mechanism of rearrangement reactions*<br>➢ *To develop the ability to apply knowledge of heterocyclic chemistry to predict the behavior of heterocyclic compounds in various chemical reactions* | | |
| 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** | **Stereochemistry**:- Introduction to conformation and conformational analysis Conformation of cyclohexane and its mono, di and poly substitute derivatives, Declain perhyroanthracene, perhydrophenanthrene, role of spectroscopy in the study o conformational analysis, Conformational and reactivity. | **12** |
| **II** | **Reactions**:- Introduction & Mechanism of Mannich reaction, Introduction & Mechanism of Oppanauer oxidation, Introduction & Mechanism of Meerven-pondorf-verley reduction, Introduction & Mechanism of Ullman reaction, Introduction & Mechanism of Sandmayer reaction, Introduction & Mechanism of Buckerer reaction, Introduction & Mechanism of Grignard reaction, Introduction & Mechanism of Kolbe's Schmidt reaction. | **11** |
| **III** | **Rearrangement:-** Introduction & Mechanism of Fries rearrangement, Introduction & Mechanism of Benzidine rearrangement, Introduction & Mechanism of Von Richter rearrangement, Introduction & Mechanism of Whitmore rearrangement, Introduction & Mechanism of Schmidt rearrangement, Introduction & Mechanism of Hoffman rearrangement, Introduction & Mechanism of Curties rearrangement, Introduction & Mechanism of Pinacol – Pinacolone rearrangement. | **11** |
| **IV** | **Reagents:-** Properties, uses and preparation of N-bromosuccinamide, Aluminum isopropoxide, Polyphosphoric acid, Sodium borohydride, Lithium Aluminium Hydride, Diazo methane, Liquid ammonia.<br>**Heterocyclic Compounds**:- Introduction, Classification and nomenclature, importance of heterocyclic compounds. Preparation and properties:- Simple (five member) – Pyrroles, Furan, Thiophene, Pyrazole, Imidazole, Iminazole, Oxazole, Thiazole, Fused (five member) – Indole, Benzofuran, Benzothiophene, Simple (six member) – Pyridine, Pyrans, Pyridazine, Pyrimidine, Pyrazine, Fused (six member) – Quinoline, Phenoxazine | **11** |
| ***Keywords*** | ***Organic Compounds, Reaction Mechanism, Named Reactions, Heterocyclic Compounds, Oxidizing and reducing Agents*** | |

*Signature of Convener & Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. Verma, D. K. (2005). Handbook of Organic Name Reactions, Reagents, and Applications (1st ed.). Elsevier.
2. *Soni, P. L., Bahl, B. S., & Bahl, A. (2019). Organic Chemistry.S. Chand & Company Ltd.*

***Reference Books Recommended –***

1. March, J. (1985). Advanced Organic Chemistry: Reactions, Mechanisms, and Structure (3rd ed.). Wiley.
2. Morrison, R. T., & Boyd, R. N. (1992). Organic Chemistry (6th ed.). Prentice-Hall of India.
3. Finar, I. L. (1973). Organic Chemistry: Stereochemistry and the Chemistry of Natural Products (Vol. 1 & 2). Longman.
4. Fieser, L. F., & Fieser, M. (1967). Current Topics in Organic Chemistry (Vol. 1). Reinhold.

**Online Resources–**

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

**Online Resources–**

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

## PART-D:Assessment andEvaluation

**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**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Honors/Honors with Research)* | | | **Semester - VII** | Session: **2024-2025** |
| 1 | **CourseCode** | **CHSE-06P** | | |
| 2 | **CourseTitle** | **ORGANIC SYNTHESIS LAB. COURSE** | | |
| 3 | **CourseType** | **DSE** | | |
| 4 | **Pre-requisite**(if,any) | - | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ Apply knowledge of organic reaction mechanisms to perform single and two-stage syntheses of various aromatic and heterocyclic compounds.<br>➢ Develop essential laboratory skills in organic synthesis, including purification techniques (crystallization, distillation, etc.) and characterization methods (melting point, IR spectroscopy).<br>➢ Demonstrate proficiency in the preparation and characterization of key aromatic and heterocyclic molecules,<br>➢ Gain experience in the synthesis of diverse organic functional groups | | |
| 6 | **CreditValue** | **1 Credits** | *Credit =30 Hours Laboratory or Field learning/Training* | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

| **PART -B: Content oftheCourse** | | |
|---|---|---|
| **TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)** | | |
| **Module** | **Topics(Coursecontents)** | **No.ofPeriod** |
| **Lab./Field Training/ Experiment Contents of Course** | **Single and Two stage organic preparations, purification and characterization** Benzylic acid from Benzoin, p- Chlorotoluine from p-Toludine, 2,4 Dinitrophenylhydrazine from Chlorobenzene, m- Nitrobenzoic acid from methy benzoate, 2,4- Dinitrophenol from Chlorobenzene, o- Aminobenzoic acid from Phthali anhydride, hydantoin from benzyl, p-Aminoazobenzene from Aniline, thiazoles fron acetophenones, pyrimidines from aldehydes/ketones and thiourea, , eosin fron resorcinol &phthalic anhydride, Indigo from anthranilic acid, methyl orange fron aniline, 5-hydroxy-1,3-benzothiole from hydroquinone,Benzimidazole from urea. | **30** |
| ***Keywords*** | ***Organic Compounds, Organic Synthesis Methods, Solvent, Purification, Characaterizition*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Singh, P. R., Kapoor, V. P., & Kapoor, I. P. S. (1981). Experimental Organic Chemistry (Vol. I & II). Tata McGraw Hill.*
2. *Dey, A. K., & Sitaraman, K. (1992). Laboratory Manual in Organic Chemistry. Allied Publishers.*
3. *Bansal, R. K. (1990). Laboratory Manual of Organic Chemistry (2nd ed.). Wiley Eastern.*

***Reference Books Recommended –***

1. *Furniss, B. S., Hannaford, A. J., Smith, P. W. G., & Tatchell, A. R. (1989). Vogel's Textbook of Practical Organic Chemistry (including Qualitative Organic Analysis). Longman Scientific & Technical.*
2. *Jag Mohan. (2003). Organic Analytical Chemistry: Theory and Practice. Narosa Publishing House.*
3. *Mann, F. G., & Saunders, B. C. (1970). Practical Organic Chemistry (4th ed.). Longman.*

**Online Resources–**

- **e-Resources / e-books and e-learning portals**
- **https://ocw.mit.edu/courses/res-5-0001-digital-lab-techniques-manual-spring-2007/pages/videos/**
- **https://extension.berkeley.edu/search/publicCourseSearchDetails.do?method=load&courseId=40422**
- **https://www.organic-chemistry.org/**

**Online Resources–**

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

## PART-D:Assessment andEvaluation

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

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

***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** *(Honors/Honors with Research)* | | | **Semester - VII** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-07T** | | |
| 2 | **Course Title** | **ENERGY SOURCES** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | *As per program* | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To understand the energy sources available.*<br>➢ *To understand the concept of energy sources working.*<br>➢ *To understand importance of and application of alternate energy sources*<br>➢ *To understand the biomass energy sources, wind energy, solar energy, wind energy.* | | |
| 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** | **Solar energy:-** Introduction, Importance, Application and Equipments of solar energy (Instrument used for solar radiation: Sun-shine recorder, pyrano meter and pyrhelio meter Device for solar thermal collection and storage: flate plate collector, cylindrical paraboli collector and paraboloid concentrating collector; Thermal application of solar energy water heating, space heating, power generation, space cooling & refrigeration, distillation drying and cooking.) | **12** |
| **II** | **Wind energy:-** Introduction, Importance, Application and Equipments of wind energy. (Utilization of wild energy, Advantages and disadvantages of wind energy, Site selection for wind farms, Basic components of wind energy conversion system-WECS, Classification of WECS) Geothermal energy:- Introduction, Importance, Application and Equipments of geothermal energy. (Geothermal sources: Hydrothermal system, Geopressured resources, Petrothermal resources, Application of geothermal energy, Advantages and disadvantages of geothermal energy over other energy forms, Operational and environment problems). | **11** |
| **III** | **Ocean thermal energy:-** Introduction, Importance, Application and Equipments of ocean thermal energy. (Ocean thermal energy conversion system-OTEC: Open cycle OTEC system, Closed cycle OTEC system) Tide energy:- Introduction, Importance, Application and Equipments of tide energy. (Components of tidal power plants: Single basin tidal power plant, Double basin tidal power plant, Advantages and disadvantages of tidal power plant.) Oceanic wave energy:- Introduction, Importance, Application and Equipments of oceanic wave energy. (Wave energy conversion device: Wave energy conversion by floats, Dolphin type wave power plant, Advantages and disadvantages of oceanic wave energy.) | **11** |
| **IV** | **Biomass energy:-** Introduction, Importance, Application and Equipments of biomass energy. (Energy from biomass, Methods of utilization, energy plantation, Biomass gasification, Classification of gasifier, Down draft gasifier, Application of gasifier, Problems associated with gasifier, Classification of biogas plants: Continuous type, Batch type, KVIC, Fixed dome type, Factors affecting biogas plants.) Energy Management:- Introduction and definition, Basic steps of energy management, Sides of | **11** |

| | | |
|---|---|---|
| | energy management and Objective of energy management. | |
| *Keywords* | ***Energy Conservation, Energy Resources, Applications of Enegy, Wave Energy, Energy Management*** | |

***SignatureofConvener&Members (CBoS):***

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

**Text Books Recommended –**

1. Sharma, S. P., & Chandramohan. (2001). Fuel and Combustion. Tata McGraw Hill Education.
2. Pandya, S. P. (2004). Conventional Energy Technology, Fuels and Chemical Energy. Tata McGraw Hill Education.

**Reference Books Recommended –**

1. Gilchrist, J. D. (1984). Fuels, Furnaces, and Refractories. Pergamon Press.
2. Coughanowr, D. R., & Koppel, L. B. (1993). Process Systems Analysis and Control. McGraw-Hill.
3. Considine, D. M. (1999). Process Instrumentation and Control Handbook: A Guide to Measurement, Communication, and Control. McGraw Hill.

**Online Resources–**

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

- https://www.energy.gov/eere/solar/solar-energy-technologies-office
- https://www.nrel.gov/
- https://gwec.net/
- "https://oceanservice.noaa.gov/economy/wind-energy/welcome.html
- "https://www.ocean-energy-systems.org/
- "https://www.ornl.gov/facility/ntrc/research-areas/bioenergy-technologies
- https://biomassmagazine.com/

## PART-D:Assessment andEvaluation

**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**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Honors/Honors with Research)* | | | **Semester - VII** | Session: **2024-2025** |
| 1 | **CourseCode** | ICSE ~~CHSE~~-07P | | |
| 2 | **CourseTitle** | **ENERGY SOURCES LAB. COURSE** | | |
| 3 | **CourseType** | **DSE** | | |
| 4 | **Pre-requisite**(if,any) | *As per program* | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To study about biogas plant*<br>➢ *To study the production process of biodiesel.*<br>➢ *To study the production process of bio-fuels.* | | |
| 6 | **CreditValue** | **1 Credits** | *Credit =30 Hours Laboratory or Field learning/Training* | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

| **PART -B: Content of theCourse** | | |
|---|---|---|
| **TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)** | | |
| **Module** | **Topics(Coursecontents)** | **No.ofPeriod** |
| **Lab./Field Training/ Experiment Contents of Course** | Biogas plants, comparison of bio-gas with other fuels, Selection of site for installatio of a bio gas plant, Production of biogas - the biogas plants.<br>Study of the production process of biodiesel.<br>Study of the production process of bio-fuels. | **30** |
| ***Keywords*** | ***Energy Conservation, Energy Resources, Applications of Enegy, Wave Energy, Energy Management*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Biomass, Biopolymer-Based Materials, and Bioenergy, 2019*
2. *Reddy, G. M., Reddy, B. V., & Ramesh, S. (2005). Biodiesel - A sustainable fuel. Allied Publishers Pvt. Ltd.*
3. *Bhattacharya, S. C., Khan, S. K., & Ambastha, A. K. (2009). Introduction to biofuels. Allied Publishers Pvt. Ltd.*
4. *Singh, S. D. (2011). Biofuels and bioenergy. Wiley India Pvt. Ltd.*

***Reference Books Recommended –***

*5.*

1. *VenkoBeschkov ,Biogas, Biodiesel and Bioethanol as Multifunctional Renewable Fuels and Raw Materials, 25 January 2017, DOI: 10.5772/65734*
2. *Raul, A. R. (2017).* Biogas digester design construction and operation. *LAP Lambert Academic Publishing.*

**Online Resources–**

- https://link.springer.com/referenceworkentry/10.1007%2F978-3-319-28251-6_121-1
- https://chemicalengineeringworld.com/extraction-processes/
- https://www.lenntech.com/library/extraction/
- https://www.vekamaf.com/equipment/extraction/
- https://chemicalengineeringworld.com/distillation-processes/

**Online Resources–**

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

## PART-D:Assessment andEvaluation

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

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

***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** *(Honors/ Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-08T** | | |
| 2 | **CourseTitle** | **MANUFACTURING AND UTILIZATION OF IRON, CEMENT AND COAL** | | |
| 3 | **Course Type** | **DSC** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To learn about the production methods of iron and its alloys*<br>➢ *To learn about the production of Cement.*<br>➢ *Apply the knowledge of recent coal utilization methods.*<br>➢ *Describe the different coal preparation methods* | | |
| 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 | **Production and casting of Iron base materials**<br>Production of Iron in blast furnace-Raw materials, charging and sequence of operations, casting ,operation of pig casting machine.<br>Manufacture of steel by Bessemer process. (Removal of silicon, decarbonisation, demanganisation, desulphurisation, dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing).<br>Production of semi-killed and killed steel in steel melting shop (LD process)- mixing of raw materials, charging sequences, operation in converter, blowing, tapping and testing process, timing in pit side, holding and stripping operations. Continuous casting of semi-finished steel products. | **12** |
| II | **Steel and Alloys (ferrous and non-ferrous): Composition, Properties and classification**<br>Composition and properties of different types of steels (role of Ni, Cr, Mo, Si, Mn, V, W, Al).<br>Classification of alloys - ferrous alloys (iron base alloys) - cast iron and steel, tool steel) and nonferrous alloys (copper, lead and tin alloys); composition of brass, bronze, cupro-nickel, manganin, constantan, antifriction bearing, solders, Pb-Sn, Pb-Sb.<br>Specific properties of elements in alloys: role of Ti in Al and Mg alloys, Ni in copper and iron alloys, Sn and Cu in lead base alloys. | **11** |
| III | **Manufacturing of Cement**<br>Cement Industry Introduction; Classification and Manufacturing processes of Cement and Lime; Setting and Hardening process.<br>Historical developmentofPortland cement, definition, chemistry of cement, Raw materials, manufacturing process of cement: dry process, semi-dry process, wet process, sequence of operations-winning of raw materials, size reduction, storage of crushed materials, grinding of raw mix. Burning the ground mix to clinker, cooling of hot clinker, | **11** |

| | | |
|---|---|---|
| | grinding the clinker mixed with gypsum, cement making Rotary kilns, reactions occurs in the different zones of rotary kiln, Refractory used in Rotary kiln. Hydration of cement, Heat of Hydration, Setting and hardening of Portland cement, Flash set and False set of cement. Pozzolana Cement, Blast Furnace slag cement, Quick setting cement, White Portland Cement, High Alumina Cement, Testing of cement.Cementindustries in India. | |
| **IV** | **Coal Processing Technology**<br>Clean coal technology, Coal processing, Screening of coal, Size reduction of coal, Pulp/Slurry density, Wash ability of coal, Coal beneficiation processes, Principles of gravity concentration processes, Heavy medium separation, Jigging, Flowing film concentration, Cyclone separation, Froth flotation, Centrifugal separators, Dry beneficiation of coal, Dewatering, Coal washing efficiency, Coal washing practice in India, Recent development in coal processing, Coal utilization, Carbonization, Coking mechanism, Selection of coal for metallurgical coke, Combustion, Gasification, Types of gasifiers, liquefaction, production of liquid fuels, carbon capture and storage | **11** |
| ***Keywords*** | ***Iron, Ferrous and non-ferrous alloys, Cement, Coal, Production, Classification, Industrial Applications*** | |

***SignatureofConvener&Members (CBoS):***

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Ray, H. S., Sridhar, R., & Abraham, K. P (2002). Extraction of Nonferrous Metals. . (Affiliated EastWest Press Pvt. Ltd.), New Delhi.*
2. *Roy, H. S., & Ghosh, A. (2004). Principles of Extractive Metallurgy, New Age International (P) Ltd., Publishers.*
3. *Sharma, B. K (2005). Industrial Chemistry. . (Geol Publishing House*
4. *SubbaRao, D. V., &Gouricharan, T. (2017). Coal Processing and Utilization, CRC Press.*

***Reference Books Recommended –***

1. *Lea, F. M. (2001). Chemistry of Cement.*
2. *46. Wilson, A. G., & Wales, C. E. (2007). Coal, Coke, and Coal Chemicals. MGH*

**Online Resources–**

- **https://www.sciencedirect.com/topics/materials-science/iron-casting**
- **https://www.worldsteel.org/steel-by-topic/manufacturing-processes/iron-making/blast-furnace.html**
- **https://www.britannica.com/technology/Bessemer-process**
- **https://www.sciencedirect.com/topics/materials-science**
- **https://www.theconstructor.org/building/cement-manufacturing-process/12138/**
- **https://www.sciencedirect.com/topics/engineering**

**Online Resources–**

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

## PART-D:Assessment andEvaluation

**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**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1.** Objective – **10 x1= 10** Mark; **Q2.** Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** |

***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** *(Honors/ Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICSE-08P** | | |
| 2 | **CourseTitle** | **MANUFACTURING AND UTILIZATION OF IRON, CEMENT AND COAL LAB. COURSE** | | |
| 3 | **CourseType** | ~~DSC~~ DSE | | |
| 4 | **Pre-requisite**(if,any) | *As per program* | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To learn about the composition analysis of iron based alloys and materials.*<br>➢ *To acquire an idea about the Nitration, Oxidation, Partial reduction, Esterification, Polymerization & chemical analysis methods of cement.*<br>➢ *Analyse the composition of supplied coal samples by proximat Analysis.*<br>➢ *Demonstrate the working principle of Bomb calorimeter.* | | |
| 6 | **CreditValue** | **1 Credits** | *Credit =30 Hours Laboratory or Field learning/Training* | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

## PART -B: Content oftheCourse

**TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)**

| Module | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course** | 1. Analysis of composition of steel, mild steel and alloys.<br>2. Estimation of Lime by Rapid Lime Method, Total Carbonate of Sample, Ful analysis ($SiO_2$, $Al_2O_3$, $Fe_2O_3$, CaO and MgO) of Cement & Clinker. Physica testing of Cement: Compressive testing, Specific surface area analysis etc.<br>3. To determine the composition of the supplied sample of Coal by Proximat Analysis<br>4. To determine the Gross calorific value of the supplied sample of coal usin Automatic Bomb Calorimeter.<br>5. Case study on iron rusting in the power plants and manufacture industries.<br>6. Case study on impact of cement particles on soil, water streams and agriculture.<br>7. Case study on impact of coal on soil, water streams and agriculture.<br>8. Detail report on industrial training. | **30** |
| *Keywords* | ***Steel, Cement, Coal, Analysis, Plant and industries, Water, Composition*** | |

*Signature of Convener & Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. Ray, H. S., Sridhar, R., & Abraham, K. P. (1995). Extraction of Nonferrous Metals. New Delhi, India: Affiliated EastWest Press Pvt. Ltd.
2. Jain, P. C., & Jain, M. (2010). Engineering Chemistry. New Delhi, India: Dhanpat Rai Publishing Co. Pvt. Ltd.
3. Sharma, B. K. (2003). Industrial Chemistry. Meerut, India: Geol Publishing House.
4. SubbaRao, D. V., &Gouricharan, T. (2014). Coal Processing and Utilization. Boca Raton, FL: CRC Press.

***Reference Books Recommended –***

1. Wilson, L. G., & Wales, C. E. (1998). Coal, Coke and Coal Chemicals. New York, NY: McGraw-Hill Education.
2. *Kent, J. A. (Ed.). (1998). Riegel's handbook of industrial chemistry. CBS Publishers & Distributors.*

**Online Resources–**

- https://www.nist.gov/materials-and-chemical-characterization/steel-alloys
- https://www.astm.org/Standards/C114.htm
- https://www.cement.ca/what-we-do/testing-certification
- https://www.usgs.gov/centers/nmic/coal-and-coalbed-gas
- https://www.iapws.org/faq1/rust.html
- https://www.epa.gov/
- https://www.osha.gov/SLTC/etools/steelmaking/index.html

**Online Resources–**

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

## PART-D:Assessment andEvaluation

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

| | | |
|---|---|---|
| **Continuous Internal Assessment(CIA):** **(By Course Teacher)** | Internal Test / Quiz-(2): **10 &10**<br>Assignment/Seminar +Attendance- **0**<br>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**<br>**V. Performed the Task based on lab. work - 20 Marks**<br>**W. Spotting based on tools& technology (written) – 10 Marks**<br>**X. Viva-voce (based on principle/technology) - 05 Marks** | **Managed by Course teacher as per lab. status** |

***Name and Signature of Convener & Members of CBoS:***

# DEPARTMENT OF INDUSTRIAL CHEMISTRY
## COURSE CURRICULUM

| **PART-A: Introduction** | | | | |
|---|---|---|---|---|
| **Program:Bachelor in Science** *(Honors/ Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-09T** | | |
| 2 | **Course Title** | **TECHNOLOGY OF SELECTED FINISHED PRODUCT – DYES** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To understand the technology of finished product.*<br>➢ *To understand the chemical constituent of finished product.*<br>➢ *To understand the process of making of finished product.*<br>➢ *To understand the applications of finished products.* | | |
| 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 | Theory of color & Chemical constitution of dyes based on textile fibers and application<br>Classification of dyes based on method of application and chemical structure.<br>Intermediate compounds:- Introduction, Classification, Synthesis of H-Acid, G-Acid, R Acid, GamaAcid, 1,2,4-Acid, AAA, Bon-Acid, B-Napthol. | 12 |
| II | Study of following group of dyes:-<br>- Proceine / Reactive dyes.<br>- Napthol dyes.<br>- Indigo &Thio Indigo dyes.<br>- Pigment dyes.<br>- Optical brighteners.<br>- Anthraquinoid dyes.<br>- Azo dyes. | 11 |
| III | Study of following group of dyes:-<br>- Nitroso dyes.<br>- Nitro dyes.<br>- Azoic dyes.<br>- DPM dyes.<br>- TPM dyes.<br>- Phthaleins dyes.<br>- Xanthene dyes. | 11 |
| IV | Non-textile use of dyes:-<br>- Food dyes.<br>- Medicinal dyes.<br>- Leather dyes.<br>- Indicators.<br>- Paper dyes. | 11 |
| *Keywords* | ***Colour & Dyes, Synthetic & Natural Dyes, Classification, Recent Applications*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Agrawal, O. P. (2001). Synthetic dyes.*
2. *Venkataraman, K. (Ed.). (1952). The chemistry of dyes and pigments. Blackie & Son Limited. (Note: Edited work, Venkataraman may not be the sole author)*
3. *Mudgal, S. P. (2015). Fundamentals of dye chemistry. New Age International (Publishers).*
4. *Desai, N. R. (2000). Textile dyes: Classification, chemistry and applications. Universal Publishing Company.*

***Reference Books Recommended –***

1. *Fierts-Dvid, H. E., & Balangey, L. (1975). Fundamental process of dye chemistry. Inter Science.*

**Online Resources–**

- https://www.sciencedirect.com/topics/medicine-and-dentistry/dye
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10685195/ https://en.m.wikipedia.org/?title=Synthetic_dyes&redirect=no -
- https://maiwa.com/collections/natural-dyes
- https://www.researchgate.net/publication/323960391_Classifications_properties_and_applications_of_textile_dyes_A_review
- https://www.slideshare.net/slideshow/dyes-and-pigments/79104161

## 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**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Honors/ Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **CourseCode** | **CHSE-09P** | | |
| 2 | **CourseTitle** | **TECHNOLOGY OF SELECTED FINISHED PRODUCT – DYES LAB. COURSE** | | |
| 3 | **CourseType** | **DSE** | | |
| 4 | **Pre-requisite**(if,any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To understand the synthesis and purification of dyes.*<br>➢ *Understanding characterization and applications of dyes.*<br>➢ *Employing different analytical methods to purify, characterize and evaluate applications of dyes.*<br>➢ *To apply spectroscopic methods to characterize and extract dyes.*<br>➢ *To conduct a visit of dye industry and preparation of report.* | | |
| 6 | **CreditValue** | **1 Credits** | *Credit =30 Hours Laboratory or Field learning/Training* | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

| **PART -B: Content of theCourse** | | |
|---|---|---|
| **TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)** | | |
| **Module** | **Topics(Coursecontents)** | **No.ofPeriod** |
| **Lab./Field Training/ Experiment Contents of Course** | • Synthesis of dyes.<br>• Chromatographic methods for dye purification.<br>• Analytical methods for dye and pigment characterization.<br>• Extraction of dyes by nanomaterials or by other means.<br>• Spectroscopic methods to characterize dyes.<br>• Visit dye industry and prepare report.<br>• Execution of field visit/seminar/report/quiz/project etc. | **30** |
| *Keywords* | ***Dye, synthesis, purification, analytical methods, spectroscopic methods, characterization of dyes, industry, nanomaterials.*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Ajayi, S. B. (2009). Dyes and dyeing in ancient India. National Book Trust, India.*
2. *Chatwal, A., & Anand, S. (2011). Instrumental methods of chemical analysis (5th ed.). Anand Publishers.*
3. *Mehta, B. K., & Singh, M. (2005). Analysis of dyes and pigments. CBS Publishers & Distributors.*
4. *Pandey, S., & Sharma, H. C. (Eds.). (2014). Nanomaterials for textiles. Elsevier.*
5. *Agarwal, Y. K. (2001). A course in instrumental analysis. Krishna Publishers.*

***Reference Books Recommended –***

1. *Zollinger, H. (2003). Colour chemistry: Syntheses, properties, and applications of organic dyes and pigments. Wiley-VCH Verlag GmbH & Co. KGaA.*
2. *Snyder, L. R., & Kirkland, J. J. (2010).* High-performance liquid chromatography *(3rd ed.). John Wiley & Sons, Inc.*
3. *Sherma, J., & Fried, B. (2002).* Modern chromatographic techniques in food analysis. *CRC Press.*

**Online Resources–**

- **e-Resources / e-books and e-learning portals**
- **https://archive.nptel.ac.in/courses/116/104/116104046/**
- **https://nptel.ac.in/courses/116104044**
- **https://onlinecourses.nptel.ac.in/noc22_te04/preview**
- **https://onlinecourses.swayam2.ac.in/cec19_te01/preview**

**Online Resources–**

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

## PART-D: Assessment and Evaluation

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

| | | |
|---|---|---|
| **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**<br>**Y. Performed the Task based on lab. work - 20 Marks**<br>**Z. Spotting based on tools& technology (written) – 10 Marks**<br>**AA. Viva-voce (based on principle/technology) - 05 Marks** | **Managed by Course teacher as per lab. status** |

***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** *(Honors/ Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-10T** | | |
| 2 | **Course Title** | **INDUSTRIAL SAFETY** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To understand concept, need, nature, size of safety problem, and importance of safety.*<br>➢ *To acquire philosophy of safety: accident, oversight, hazard, types of accident, accident prevention and five E's of accident prevention.*<br>➢ *To acquire safety psychology: factors affecting accidents, behavior based safety, and motivation.*<br>➢ *To understand and acquire instrumental and electricity safety measures.*<br>➢ *Handling of fire and explosions.* | | |
| 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 | **Introduction of safety**: - Introduction, concept of safety: definition of safety, need fo safety, nature of safety, importance of safety, focus on human resources, concept o development, modern concept of SHE or HSE. Problems of industrial safety: Classification, problems of industrial accidents, occupational health and environmenta pollution, nature and size of safety problems, factors impending safety, reasons fo accident prevention, place of industry and safety are inevitable, importance of safety | **12** |
| II | **Machine tool, hand tool and power tool for safety and machine guarding**: - Introduction, classification and important aspects of machine tools, hand tools and power tools. | **11** |
| III | **Electrical safety and static electricity:** -Introduction of flammable gases, affected criteria in electrical safety system, introduction of static electricity, ground fault circuit protection, electric work in hazardous atmosphere. | **11** |
| IV | **Fire and explosion:** -Introduction of fire and explosion, elements and classification of fire, and importance aspects of fire and explosion. | **11** |
| ***Keywords*** | ***Safety, machine guarding, electrical safety, fire safety, industrial gaes safety, accidents, safety importance, hazardous atmosphere.*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Reddy, M. J. (Industrial safety and hazard prevention [4th ed.]). Khanna Publishers.*
2. *Mahajan, L. M. (Industrial safety management [5th ed.]). McGraw Hill Education (India) Private Limited.*
3. *Verma, N. K. (Safety in industry). Metropolitan Book Co. Pvt. Ltd.*

***Reference Books Recommended –***

1. *Wilson, L., McCutcheon, D., & Buchanan, M. (2003). Industrial safety and risk management. University of Alberta.*
2. *Heinrich, H. W. (1931). Industrial accident prevention: A manual for industrial executives. McGraw-Hill.*
3. *Rogers, W. L., & Blunt, R. M. (2000). Safety and health for engineers (2nd ed.). Pearson Education.*
4. *Mangum, G. A. (2007). Industrial safety management (5th ed.). Pearson Prentice Hall.*
5. *Dick, H.-J. (Ed.). (2000). Handbook of machinery safety (Vol. 1: Fundamental principles and technical rules). Wiley-VCH Verlag GmbH & Co. KGaA.*
6. *Lees, F. P. (2005). Fire protection for the process industries (2nd ed.). Butterworth-Heinemann.*

**Online Resources–**

- **e-Resources / e-books and e-learning portals**
- **https://onlinecourses.nptel.ac.in/noc24_mg52/preview**
- **https://onlinecourses.swayam2.ac.in/nou23_ge81/preview**
- **https://onlinecourses.nptel.ac.in/noc22_ce39/preview**
- **https://archive.nptel.ac.in/courses/110/105/110105094/**
- **https://www.igmpi.ac.in/HSE/Adword.php?gad_source=1&gclid=Cj0KCQjwltKxBhDMARIsAG8KnqXSDtyTJhZZoG5qYbuHpYxjKB6l6ShXdQvlDoL9qur6UKB0SotICbgaApUPEALw_wcB**

**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**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1.** Objective – **10 x1= 10** Mark; **Q2.** Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Honors/ Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **CourseCode** | **CHSE-10P** | | |
| 2 | **CourseTitle** | **INDUSTRIAL SAFETY LAB. COURSE** | | |
| 3 | **CourseType** | **DSE** | | |
| 4 | **Pre-requisite**(if,any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To acquire knowledge about fire incidents, and their management.*<br>➢ *To acquire knowledge about chemical lincidents, management, and importance.*<br>➢ *To acquire knowledge about lab safety measures.*<br>➢ *Understanding need, management, and importance of safety.* | | |
| 6 | **CreditValue** | **1 Credits** | *Credit =30 Hours Laboratory or Field learning/Training* | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

| **PART -B: Content of theCourse** | | |
|---|---|---|
| **TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)** | | |
| **Module** | **Topics(Coursecontents)** | **No.ofPeriod** |
| **Lab./Field Training/ Experiment Contents of Course** | • Report/model/project on fire safety.<br>• Report/model/project on chemical safety.<br>• Report/model/project on lab safety.<br>• Visit of an industry and understand safety management and prepar report/project what did the students learn?<br>• Seminar/quiz on safety need, management, and importance.<br>• Safety awareness programs.<br>• Safe handling of typical laboratory instruments.<br>• Incidence response and emergency planning.<br>• Safe handling of industrial gases.<br>• Case studies based on historical lab accident reports. | **30** |
| *Keywords* | ***Safety, lab safety, fire safety, chemical safety, management, project, report, seminar, visit, industry, Gas handling, incidence, emergency.*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Reddy, M. J. (Industrial safety and hazard prevention [4th ed.]). Khanna Publishers.*
2. *Mahajan, L. M. (Industrial safety management [5th ed.]). McGraw Hill Education (India) Private Limited.*
3. *Verma, N. K. (Safety in industry). Metropolitan Book Co. Pvt. Ltd.*

***Reference Books Recommended –***

1. *Wilson, L., McCutcheon, D., & Buchanan, M. (2003). Industrial safety and risk management. University of Alberta.*
2. *Heinrich, H. W. (1931). Industrial accident prevention: A manual for industrial executives. McGraw-Hill.*
3. *Rogers, W. L., & Blunt, R. M. (2000). Safety and health for engineers (2nd ed.). Pearson Education.*
4. *Mangum, G. A. (2007). Industrial safety management (5th ed.). Pearson Prentice Hall.*
5. *Dick, H.-J. (Ed.). (2000). Handbook of machinery safety (Vol. 1: Fundamental principles and technical rules). Wiley-VCH Verlag GmbH & Co. KGaA.*
6. *Lees, F. P. (2005). Fire protection for the process industries (2nd ed.). Butterworth-Heinemann.*

**Online Resources–**

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

- **https://onlinecourses.nptel.ac.in/noc24_mg52/preview**
- **https://onlinecourses.swayam2.ac.in/nou23_ge81/preview**
- **https://onlinecourses.nptel.ac.in/noc22_ce39/preview**
- **https://archive.nptel.ac.in/courses/110/105/110105094/**
- **https://www.igmpi.ac.in/HSE/Adword.php?gad_source=1&gclid=Cj0KCQjwltKxBhDMARIsAG8KnqXSDtyTJhZZoG5qYbuHpYxjKB6l6ShXdQvlDoL9qur6UKB0SotICbgaApUPEALw_wcB**

**Online Resources–**

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

## PART-D:Assessment andEvaluation

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

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

*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** *(Honors/ Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-11T** | | |
| 2 | **Course Title** | **MODERN ANALYTICAL TECHNIQUES-II** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *Demonstrate Proficiency in Operating UV-Visible Spectrophotometers*<br>➢ *Interpret Infrared Spectra to Identify Functional Groups*<br>➢ *Analyze NMR Spectra to Determine Molecular Structure*<br>➢ *Quantify Elemental Concentrations Using Atomic Absorption Spectroscopy (AAS)*<br>➢ *Apply Spectroscopic Techniques to Solve Analytical Problems* | | |
| 6 | **Credit Value** | **3 Credits** | ***Credit = 15 Hours -learning & Observation*** | |
| 7 | **Total Marks** | **Max. Marks: 100** | **Min Passing Marks:40** | |

| **PART -B: Content oftheCourse** | | |
|---|---|---|
| **Total No.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)** | | |
| **Unit** | **Topics(Course contents)** | **No.of Period** |
| **I** | **UV Spectroscopy**: Wave-like propagation of light, absorption of electromagnetic radiation by organic molecules allowed and forbidden transitions, instrumentation, effect of solvents on electronic transitions, formation and designation of absorption bands conjugated systems and transition energies, unsaturated carbonyl compounds, dienes and conjugated polyenes, Woodward–Fieserrules. | **12** |
| **II** | **IR Spectroscopy**: Introduction, absorption in the infrared region, theory of infrared spectroscopy, instrumentation, molecular vibrations, calculation of vibrational frequencies, factors affecting vibrational frequencies, characteristic absorptions in common classes of compounds, fingerprint region, characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ether, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, acids, anhydrides), applications of infrared spectroscopy. | **11** |
| **III** | **NMR Spectroscopy**: Introduction, theory of NMR spectroscopy, Instrumentation, chemical shift, equivalent and nonequivalent protons, spin-spin splitting, vicinal coupling and stereostructure, proton exchange reactions, principle of C-13 NMR spectroscopy, Relaxation and dynamic processes - Spin lattice relaxation (T1) and Spin - spin relaxation (T2) measurements. Interpretation of NMR spectra of some representative compounds. | **11** |
| **IV** | **Atomic Absorption Spectrophotometry**: Introduction, Principle, Instrumentation, Interferences- Spectral, Ionization, Physical and Refractory compound formation, Sample preparation, Internal standard and standard addition calibration and applications of AAS. | **11** |
| ***Keywords*** | ***Molecular Spectroscopy, Absorption, Instrumentation, Frequency, Nucleolus, NMR, AAS*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C :Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Kaur, H. (2018). Spectroscopy. Pragati Prakashan.*
2. *Sharma, B. K. (**2010**). Spectroscopy comprehension. Goel Publishing House.*

***Reference Books Recommended –***

*1. Pavia, D. L., Lampman, G. M., & Kriz, G. S. (2008). Introduction to spectroscopy (3rd ed.). Brooks/Cole.*

*2. Williams, H., & Fleming, I. (2007). Spectroscopic methods in organic chemistry (5th ed.). McGraw-Hill Education.*

*3. Kemp, W. (2011). Organic spectroscopy (3rd ed.). Palgrave Macmillan.*

*4. Skoog, D. A., West, D. M., & Holler, F. J. (1995). Fundamentals of analytical chemistry (7th ed.). Harcourt Brace College Publishers*

**Online Resources–**

- **https://www.spectroscopyonline.com/**
- **https://webbook.nist.gov/chemistry/**
- **https://www.rsc.org/spectra/**
- **https://www.wiley.com/en-us/Spectra+Lab-p-9781119451987**
- **https://axial.acs.org/spectroscopy-resource-center/**

**Online Resources–**

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

## PART-D: Assessment andEvaluation

**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**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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 Sciene *(Honors/ Honors with Research)* | Semester VIII | Session: 2024-2025 |
|---|---|---|

| | | | |
|---|---|---|---|
| 1 | CourseCode | ICSE-11P | |
| 2 | CourseTitle | MODERN ANALYTICAL TECHNIQUES-II LAB. COURSE | |
| 3 | CourseType | DSE | |
| 4 | Pre-requisite(if,any) | *As per program* | |
| 5 | Course Learning. Outcomes(CLO) | ➢ *To Learn the structure elucidation of compound by spectroscopic data.*<br>➢ *To learn Spectrophotometric estimation of data.*<br>➢ *To learn the pH Metry*<br>➢ *To learn the chromatographic separation.* | |
| 6 | CreditValue | 1 Credits | *Credit =30 Hours Laboratory or Field learning/Training* |
| 7 | TotalMarks | Max.Marks:50 | Min Passing Marks:20 |

**PART -B: Content oftheCourse**

TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)

| Module | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| Lab./Field Training/ Experiment Contents of Course | 1. Project on structure elucidation by spectroscopic data of $^{1}$H-NMR,$^{13}$C-NMR, IR,UV spectroscopy and Mass spectrometry.(Experimental data sheet different simple compound can be provided to the student as a task eg. ethanol, propanol, ethyl acetate,nitrophenol,toluene,1,22-tribomoethane etc.)<br>2. Determination of Fe (II) in a sample of well water with thiocyanate as complexation agent, spectrophotometrically<br>3. Determination of λmax of Potassium permanganate (KMn04)solution.<br>4. Verification of the lambert beer's Law for $KMnO_4$ / $K_2Cr_2O_7$ and determination of concentration given unknown solution of the compound.<br>5. Determination of Aluminum in a given sample solution, spectrophotometrically.<br>6. Determination of concentration of sodium in an aquous solution by using a flame photometer.<br>7. Determination of concentration of an acidic solution by pH metric titrations.<br>8. Determination of the isoelectric pointof a protein.<br>9. The standardization of an Fe (II) solution with a standard dichromate solution over Pt and Calomel assembly.<br>10. Determination of concentration of Ce (IV) Sulfate solution with a standard Fe (II) Solution over Pt and calomel assembly.<br>11. Separation of permanganate and dichromate ions from a binary mixture on an alumina column | 30 |
| *Keywords* | ***Structure elucidation,pH-Metry,Potentiometry,Chromatographic experiment paper and column,NMR,IR,UV-Visible,Mass.*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Chatwaal, R., & Anand, B. (2000). Instrumental Methods of Chemical Analysis. Himalaya Publishing House.*
2. *Janarthanam, P. B. (2000). Physico Chemical Techniques of Analysis (Vol. I & II). Asian Publishing.*
3. *Sharma, B. K. (2008). Instrumental Methods of Chemical Analysis. Goel Publications.*

***Reference Books Recommended –***

1. *Skoog, D. A., & Saunders, Jr., J. B. (1985). Principles of Instrumental Methods of Analysis (3rd ed.). College Publications.*
2. *Willard, H. H., Merritt, L. L., Dean, J. A., & Settle Jr., F. A. (1991). Instrumental Methods of Analysis (7th ed.). Saunders College Publishing.*
3. *Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of Instrumental Analysis (6th ed.). Cengage Learning. ISBN 0-495-01201-7*
4. *Pavia, D. L., Lampman, G. M., Kriz, G. S., & Vyvyan, J. A. (2014). Spectroscopy (5th ed.). Cengage Learning.*

**Online Resources:**

- https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/spectrpy/spectro.htm
- https://webbook.nist.gov/chemistry/
- https://edu.rsc.org/resources/spectroscopy/847.article
- https://pubs.acs.org/doi/abs/10.1021/es203272z
- https://www.eku.edu/phygeosast/directory/

## PART-D: Assessment and Evaluation

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

| | | |
|---|---|---|
| **Continuous Internal Assessment(CIA):** **(By Course Teacher)** | Internal Test / Quiz-(2): **10 &10**<br>Assignment/Seminar +Attendance- 05<br>Total Marks -**15** | Better marks out of thetwo Test / Quiz +obtained marks in Assignment shall be considered against **15** Marks |

| | | |
|---|---|---|
| **End Semester Exam (ESE):** | **Laboratory / Field Skill Performance: On spot Assessment**<br>**EE. Performed the Task based on lab. work - 20 Marks**<br>**FF.Spotting based on tools& technology (written) – 10 Marks**<br>**GG. Viva-voce (based on principle/technology) - 05 Marks** | **Managed by Course teacher as per lab. status** |

***Name and Signature of Convener & Members of CBoS:***

# DEPARTMENT OF INDUSTRIAL CHEMISTRY
## COURSE CURRICULUM

| **PART-A: Introduction** | | | | |
|---|---|---|---|---|
| **Program:Bachelor in Science** *(Honors/ Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSE-12T** | | |
| 2 | **Course Title** | **TECHNOLOGY OF SELECTED FINISHED PRODUCT – DRUGS** | | |
| 3 | **Course Type** | **DSE** | | |
| 4 | **Pre-requisite**(if,any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ ***Understanding Drug Development Process***<br>➢ ***Mastery of Pharmaceutical Manufacturing Techniques***<br>➢ ***Students will apply quality assurance and quality control principles in pharmaceutical manufacturing***<br>➢ ***Students will learn about pharmacokinetic and pharmacodynamic principles governing drug absorption, distribution, metabolism, and excretion*** | | |
| 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 | **Preparation and application of following group of drugs**:- - Antimalarial drugs: Chloroquine, Premaquine. - Antipyretics and Analgesic drugs:-Antipyrine, Phenacetin Paracetamol, Aspirin, Salol. - Sulpha drugs or Antibacterial drugs:-Sulphathiazole, Sulf Pyrimidines, Sulfacetamide, SulphaFurazole. - Anti TB drugs:- p-Amino salicylic acid. Antidiabitic drugs:-Tolbutamide. - Anticancer drugs:-Chlorambucil. | 12 |
| II | **Preparation and application of following group of drugs**:- - Anthelmincts and Antiseptic Drugs:- n-Hexyl Resorcinol, Chloramine-T, Vioform, Chlorocarvacrol. - Anaestheticdrugs:- Diethyl ether, Benzocaine, Procaine, Stovene. - Antipasmodic:- Atropine, Papaverine. - Antihistamine:- Benadryl, Avil. - Anticoagulants Drugs:- Dicoumarol, Valium. - Antilepretic Drugs: Dapsone. - Antibiotic Drugs: Chloramphenicol. | 11 |
| III | **Industrial production of following Drugs**:- - Insulin, Darvon, Caffiene, Camphor, Paracetamopl, Aspirin, Sorbitol, Acetanilide, Morphine, Cocaine, Codeine. | 11 |
| IV | **Synthesis of following important drugs**:- - Mebonadazole, Tolbutamie, Isoniazid, Metronidazole, Diphenhydramine, Antiphetamine, Chlorambucil, Chlorpromazine, Ibuprofen, Sulphmenoxazole. Information of Good Manufacture Practice (GMP), Good Laboratory Practice (GLP), Codex, Pharmacopeia and Codex monogram. | 11 |
| ***Keywords*** | ***Drug Molecules, Biomedical Applications, Antibiotic, Drug Synthesis, Good Laboratory Practice*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. Soni, P. L., & Chawla, H. M. (2007). Organic Chemistry. New Age International.
2. *Kar, A. (2004). Medicinal Chemistry. New Age International Publishers.*
3. *Jain, A. K. (2009). Introduction to Pharmaceutical Chemistry. Pharma Book Publications.*

***Reference Books Recommended –***

1. *Burger, A. (Ed.). (2003). Medical Chemistry Part 1 & 2. Wiley Inter Science.*
2. *Jenkins, G. S., Smith, H. A., &Wikel, J. H. (1982). Chemistry of Organic Medicinal Products. Wiley Inter Science.*
3. *Gennaro, A. R. (Ed.). (1995). Remington's Pharmaceutical Sciences. Mach Publishing Company*

**Online Resources–**

- https://www.who.int/
- https://www.ncbi.nlm.nih.gov/books
- https://www.niaid.nih.gov/diseases-conditions
- https://www.aaaai.org/conditions-and-treatments/drug-guide
- http://ijrpc.com/invited_article.php?inv_id=8

**Online Resources–**

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

## PART-D:Assessment andEvaluation

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

| | | |
|---|---|---|
| **Continuous InternalAssessment(CIA): (By Course Teacher)** | Internal Test / Quiz-(2): **20 +20**<br>Assignment/Seminar- **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks** | |

***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** *(Honors/ Honors with Research)* | | | **Semester - VIII** | Session: **2024-2025** |
| 1 | **CourseCode** | **CHSE-12P** | | |
| 2 | **CourseTitle** | **TECHNOLOGY OF SELECTED FINISHED PRODUCT – DRUGS LAB. COURSE** | | |
| 3 | **CourseType** | **DSE** | | |
| 4 | **Pre-requisite(if,any)** | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To understand the synthesis of drug of different types.*<br>➢ *To understand the need of basic need of drug synthesis.*<br>➢ Understanding Drug Development Process.<br>➢ Student will learn to determine the percentage purity of a drug. | | |
| 6 | **CreditValue** | **1 Credits** | ***Credit =30 Hours Laboratory or Field learning/Training*** | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

## PART -B: Content oftheCourse

**TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)**

| **Module** | **Topics(Coursecontents)** | **No.ofPeriod** |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course** | 1. To prepare and submit tolbutamide from p-toluene sulfonamide and calculate it percentage yield.<br>2. To Prepare and submit chlorbutanol from acetone and calculate the Percentag Yield.<br>3. To Synthesis and submit Synthesis of 7- Hydroxy -4- methyl coumarin.<br>4. To synthesis and submit sulphanilamide from p-acetamido benzen sulphanilamide and calculate its percentage yield.<br>5. To prepare and submit hexamine from formaldehyde and calculate it' Percentage Yield.<br>6. To determine the percentage purity of given sample of Isonicotic acid hydrazid tablet.<br>7. To determine the percentage purity of given sample of Metronidazole tablet.<br>8. To determine the percentage purity of given sample of tablet.<br>9. To determine the percentage purity of given sample of Chlorpheniramin malate.<br>10. To determine the percentage purity of given sample of Benzyl penicillin tablet. | **30** |
| ***Keywords*** | ***Sulfanilamide,Chlorbutanol,7-hydroxy-4-methylcoumarin,hexamine*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. Mehrotra, K. N. (2001). Handbook of Drugs and Cosmetic Act.
2. *Connors, K. A. (1982). Textbook of Pharmaceutical Analysis. Wiley Eastern Limited.*
3. *Ahluwalia, V. K. (2012). Pharmaceutical Analysis. BCS Publishers & Distributors Pvt. Ltd.*

***Reference Books Recommended –***

1. *Remstad, K. G. (1998). Modern Pharmacognosy. McGraw Hill.*
2. *Indian Pharmacopoeia. (1985).*
3. *British Pharmacopoeia. (1990).*
4. *Pharmaceutical Dosage Forms.*
5. *Li, J. J., Johnson, D. S., & Smith, S. C. (Eds.). (2017). Current Drug Synthesis. Wiley.*
6. *Patrick, G. L. (2013). Introduction to Drug Synthesis. Oxford University Press.*

**Online Resources–**

- **https://www.ncl-india.org/**
- **https://www.iict.res.in/**

## PART-D:Assessment andEvaluation

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

| | | |
|---|---|---|
| **Continuous Internal Assessment(CIA): (By Course Teacher)** | Internal Test / Quiz-(2): **10 &10**<br>Assignment/Seminar +Attendance-**05**<br>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**<br>**HH. Performed the Task based on lab. work - 20 Marks**<br>**II. Spotting based on tools& technology (written) – 10 Marks**<br>**JJ. Viva-voce (based on principle/technology) - 05 Marks** | **Managed by Course teacher as per lab. status** |

***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** | **ICGE-01T** | | |
| 2 | **Course Title** | **INDUSTRIAL TECHNOLOGY, METALLURGY AND SURFACE CHEMISTRY** | | |
| 3 | **Course Type** | **GE** | | |
| 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.*<br>➢ *To gain expertise in unit operations like distillation, absorption, evaporation, filtration, and drying, essential for industrial chemical processes.*<br>➢ *To Analyze separation techniques and equipment selection*<br>➢ *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<br>**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**<br>[A] **Distillation**-Introduction: Batch & continuous distillation, separation of azeotropes, plate columns and packed columns.<br>[B] **Absorption** - Introduction, Equipments - Packed columns, spray columns, bubble columns, packed bubble columns, mechanically agitated contractors. | 11 |
| IV | **Chemical Technology - II**<br>[A] **Evaporation**-Introduction, Equipments short tube (standard) evaporators, forced circulation evaporators, falling film evaporators, climbing film(Upward flow) evaporators.<br>**[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.<br>**[C] Drying** – Introduction, free moisture, bound moisture, Equipments, tray dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer. | 11 |
| ***Keywords*** | ***Metallurgy, Ancient Chemical Techniques, Extraction, Materials, Distillation, Separation, Processing*** | |

*Signature of Convener & Members (CBoS) :*

## PART–C: Learning Resources

**Text Books, Reference Books and Others**

**Textbooks 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.*
6. *Chattopadhyay, P. (2000). Unit Operations of Chemical Engineering (Vol. 1). Khanna Publishers.*

**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. *Adamson, A. W. (1990). Physical chemistry of surfaces (6th ed.). John Wiley & Sons.*
4. *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**<br>Assignment / Seminar - **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks**<br>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 | **CourseCode** | **ICGE-01P** | | |
| 2 | **CourseTitle** | **INDUSTRIAL CHEMISTRY LAB. COURSE-I** | | |
| 3 | **CourseType** | **GE** | | |
| 4 | **Pre-requisite(if,any)** | - | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ ***Identify potential safety hazards in a chemistry laboratory.***<br>➢ ***Become familiar with common laboratory safety procedures and protocols.***<br>➢ ***Learn about the appropriate Personal Protective Equipment (PPE) for various situations.***<br>➢ ***Understand the importance of safe handling and disposal of chemicals.*** | | |
| 6 | **CreditValue** | **1 Credits** | ***Credit =30 Hours Laboratory or Field learning/Training*** | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

## PART -B: Content oftheCourse

**TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)**

| Module | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| **Lab./Field Training/ Experiment Contents of Course** | **Introduction to laboratory safety rules and regulations.**<br>Identification of common hazards in the lab, including: Flammable liquids, Corrosive chemicals<br>Toxic substances, Electrical hazards, Glassware breakage, Demonstration and practice of safe laboratory practices<br>**Introduction to standard solutions and their applications.**<br>Distinguishing between primary and secondary standards with examples.<br>Gravimetric preparation of a primary standard solution<br>Standardization of a secondary standard solution<br>**Introduction to temperature measurement and the significance of accuracy.**<br>Explanation of the concept of calibration and its necessity.<br>Calibration of a laboratory thermometer using a reference standard (e.g., mercury thermometer) at different temperatures.<br>Preparation of buffers: Identifying suitable weak acids and conjugate bases for buffer preparation<br>Selecting appropriate buffer components based on desired pH range<br>**Preparation Methods:**<br>Calculating the amounts of acid and conjugate base needed for buffer solutions<br>Chromatography-**Column Chromatography:** Theory and applications of separation based on adsorption, partition, and size exclusion.<br>**Paper Chromatography:** Principles of separation on paper media, visualization techniques, and applications.<br>**Thin Layer Chromatography (TLC):** Introduction to TLC plates, solvent systems, development techniques, and applications<br>**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. Pandey, O. P., & et al. (2010). Practical Chemistry (For B.Sc. I, II and III Year Students). S Chand.
2. Venkateswaran, V. (2012). *Basic principles of practical chemistry*. Sultan Chand & Sons.

***Reference Books Recommended –***

1. *Seiler, J.P. (2005). Good Laboratory Practices: the why and how. Springer-Verlag Berlin andHeidelberg 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 andEvaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 50 Marks**
**ContinuousInternal Assessment(CIA):15 Marks**
**EndSemesterExam(ESE):35Marks**

| | | |
|---|---|---|
| **Continuous InternalAssessment( CIA):** **(By Course Teacher)** | Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks -**15** | Better marks out of thetwo Test / Quiz +obtained marks in Assignment shall be considered against **15** Marks |
| **End Semester Exam (ESE):** | **Laboratory / Field Skill Performance: On spot Assessment**<br>**A. Performed the Task based on lab. work - 20 Marks**<br>**B. Spotting based on tools& technology (written) – 10 Marks**<br>**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:***

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

| **PART- A: Introduction** | | | | |
|---|---|---|---|---|
| **Program: Bachelor in Science** *(Certificate / Diploma / Degree/Honors)* | | | **Semester - II** | Session: **2024-2025** |
| 1 | **Course Code** | **ICGE-02T** | | |
| 2 | **Course Title** | **INDUSTRIAL OPERATIONS, FUELS AND ASPECTS OF PHYSICAL CHEMISTRY** | | |
| 3 | **Course Type** | **GE** | | |
| 4 | **Pre-requisite** (if, any) | - | | |
| 5 | **Course Learning. Outcomes (CLO)** | ➢ *Analyze the properties, advantages, and limitations of various fuel types and their combustion processes.*<br>➢ *Evaluate the composition, refining processes, and applications of petroleum products and alternative fuels.*<br>➢ *Explain the principles and technologies involved in boiler operation, water treatment, and fluid flow systems.*<br>➢ *Differentiate between homogeneous and heterogeneous catalysis, exploring their applications in industrial reactions and enzyme-mediated processes.* | | |
| 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** | **Fuel Chemistry:**<br>**[A] Fuel** - Types of fuels, advantages and disadvantages, combustion of fuels, calorific value<br>**[B] Petroleum:** Composition of crude petroleum, refining and petroleum products and their applications, fractional distillation of crude oil, natural gas, non petroleum fuels- CNG, LNG, biogas, fuels from biomass and wastes. Cracking, reforming, hydro forming, isomerization.<br>**[C] Coal**: Types, structure, properties, distillation of coal, chemicals derived from coal | **12** |
| **II** | **[A] Boilers**<br>Classification of boilers based on: Working pressure (low, medium, high), Heat source (fuel-fired, electric), Steam generation (fire-tube, water-tube), Fire-tube boilers (Lancashire boiler, Cornish boiler), Water-tube boilers (Babcock & Wilcox boiler, LaMont boiler), High-pressure boilers (Benson boiler), Electric boilers.<br>**[B] Water Treatment**<br>**Methods of Water Treatment:**<br>Pre-treatment methods: Sedimentation and filtration, Softening techniques ( ion exchange, lime-soda process), Degasification<br>Internal treatment methods: Boiler water conditioning with chemicals ( blowdown, phosphate dosing) | **11** |
| **III** | **[A] Fluid Flow**: Fans, blowers, compressors, vacuum pumps, ejector.<br>**[B]Pumps**: Reciprocating pumps, Gear pumps, centrifugal Pumps. | **11** |
| **IV** | **[A]Catalysis**: Introduction, Types, Homogeneous and Heterogeneous, Basic principles, Mechanisms, factors affecting the performance. | **11** |

| | | |
|---|---|---|
| | **[B] Enzyme catalysis** - Rate model, industrially important reactions | |
| *Keywords* | ***Fuel Types, Combustion, Petroleum Refining, Alternative Fuels, Boilers, Water Treatment, Fluid Flow, Catalysis, Enzymes*** | |

***Signature of Convener & Members (CBoS) :***

## PART–C: Learning Resources

***Text Books Recommended –***

1. *Vermani, O. P., & Narula, A. K. (2007). Industrial Chemistry. Galgotia Publications Pvt. Ltd.*
2. *Bhatia, S. C. (2014). Chemical Process Industries, Vol. I & II. CBS Publishers.*
3. *Jain, P. C., & Jain, M. (2012). Engineering Chemistry. Dhanpat Rai & Sons.*
4. *Gopalan, R., Venkappayya, D., & Nagarajan, S. (2016). Engineering Chemistry. Vikas Publication.*
5. *Sharma, B. K. (2018). Engineering Chemistry. Goel Publishing House.*
6. *Sharma, B. K. (2019). Industrial Chemistry. Goel Publishing House.*
7. *Puri, B. R., & Sharma, L. R. (2016). Physical Chemistry. Goel Publishing House.*

***Reference Books Recommended –***

1. *Lundqvist, H. (Ed.). (2022). Industrial chemical processes: Material flows, thermodynamics, and sustainability (2nd ed.). Academic Press.*
2. *Speight, J. G. (2016). Petroleum refining: Processes, optimization, and economics (5th ed.). Marcel Dekker.*
3. *Brauer, J. E. (2017). Engineering principles in process technology (4th ed.). McGraw-Hill Education.*

***Text Books Recommended -***

**Online Resources–**

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

- **https://www.energy.gov/**
- **https://www.eia.gov/**
- **https://science.howstuffworks.com/environmental/energy/oil-refining.htm**
- **https://www.eia.gov/coal/**
- **https://www1.grc.nasa.gov/research-and-engineering/**
- **https://learncheme.com/**
- **https://www.nationalboard.org/**
- **https://www.asme.org/getmedia/c041390f-6d23-4bf9-a953-646127cfbd51/asme-bpvc-brochure-webview.pdf:**

**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**<br>Assignment / Seminar - **10**<br>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**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks**<br>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 OFINDUSTRIAL CHEMISTRY
## COURSE CURRICULUM

| **PART-A: Introduction** | | | | |
|---|---|---|---|---|
| **Program:Bachelor in Science** *(Certificate / Diploma / Degree/Honors)* | | | **Semester - II** | Session: **2024-2025** |
| 1 | **CourseCode** | **ICGE-02P** | | |
| 2 | **CourseTitle** | **INDUSTRIAL CHEMISTRY LAB. COURSE-II** | | |
| 3 | **CourseType** | **GE** | | |
| 4 | **Pre-requisite(if,any)** | **-** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ ***Understand the theoretical principles behind various purification techniques.***<br>➢ ***Apply crystallization, distillation, and extraction methods in the laboratory for sample purification.***<br>➢ ***Analyze boiling point diagrams and interpret data from physical constant measurements.***<br>➢ ***Perform basic experiments to detect food adulteration.*** | | |
| 6 | **CreditValue** | **1 Credits** | ***Credit =30 Hours Laboratory or Field learning/Training*** | |
| 7 | **TotalMarks** | **Max.Marks:50** | | **Min Passing Marks:20** |

| **PART -B: Content oftheCourse** | | |
|---|---|---|
| **TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)** | | |
| **Module** | **Topics(Course contents)** | **No. of Period** |
| **Lab./Field Training/ Experiment Contents of Course** | Simple laboratory techniques crystallization, Fractional Crystallization, Distillation, FractionalDistillation, Boiling Point Diagram.<br>Extraction Processes- Phase diagram, partition coefficient.<br>Depression and elevation in B.P. /M.P. of solids and liquids.<br>Ore analysis dolomite, limestone- calcite<br>Analysis of alloys such as cupro-nickel.<br>Determination of Physical constants: refractive-index, surface tension,effect of surfactants, on surface tension, viscosity, fluids, polymer solutions effect ofadditives on viscosity, optical rotation.<br>Study, experiments/ demonstration experiments.<br>Detection of food adulteration. | **30** |
| ***Keywords*** | ***Laboratory Techniques, Extraction, Ores analysis, Physical Constants, Food Adulteration*** | |

***Signature of Convener &Members (CBoS) :***

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. Venkateswaran, V. (2012). *Basic principles of practical chemistry*. Sultan Chand & Sons.
2. Vishnoi, N. K. (2010). *Advanced practical organic chemistry* (3rd ed.). Vikas Publishing House Pvt Ltd.

***Reference Books Recommended –***

1. *Vogel, A. I. (2012). Vogel's textbook of practical organic chemistry. Pearson Education.*
3. *Klein, D. R. (2012). Experimental organic chemistry. John Wiley & Sons.*
4. *Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry. Brooks/Cole.*
5. *4. Nielsen, S. S. (2010). Food analysis laboratory manual. Food Science Text Series.*

**Online Resources–**

- **https://chem.libretexts.org/**
- **https://www.khanacademy.org/science/chemistry**
- **https://www.chemguide.co.uk/**
- **https://pubs.acs.org/journal/ancham**
- **https://www.azom.com/**
- **https://www.virtualchemlab.com/**
- **https://www.sciencebuddies.org/science-fair-projects/references/science-fair-materials/measuring-food-adulteration**

## PART-D:Assessment andEvaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 50 Marks**
**ContinuousInternal Assessment(CIA):15 Marks**
**EndSemesterExam(ESE):35Marks**

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

***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 - II/IV/V/VI** | Session: **2024-2025** |
| 1 | **Course Code** | **ICSEC** | | |
| 2 | **Course Title** | **WATER REMEDIATION AND CONSERVATION STUDIES THEORY AND PRACTICAL** | | |
| 3 | **Course Type** | **SEC** | | |
| 4 | **Pre-requisite**(if,any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *Understand about Sources and Effect of Water Pollution.*<br>➢ *Learn about various control techniques.*<br>➢ *Learn and develop different approaches for water conservation.*<br>➢ *To execute case study/project on environmental pollution & conservation* | | |
| 6 | **Credit Value** | **2 Credits (1C + 1C)** | ***Credit = 15 Hours –Theoretical learning and = 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 Teaching–learning Periods:**
**Theory–15 Periods (15 Hrs) and Lab. or Field learning/Training 30 Periods (30 Hours)**

| Module | Topics(Course contents) | No.of Period |
|---|---|---|
| **Theory Contents** | **Water Pollution**<br>Sources of water pollutants, pollutants, Industrial and human contribution, WHO recommendation about potable water, current scenario of drinking water quality.<br>**Remediation Techniques**<br>Remediation, techniques involved such as adsorption, coagulation-filtration,Nalgonda techniques, reverse osmosis, activated charcoal detoxification, mechanisms of detoxification, bioremediation, need of green chemistry, future scope.<br>**Water Conservation**<br>Introduction to water conservation and erosion of soil, forms of water erosion, factors affecting water erosion, types of water erosion, mechanics of water erosion control. | **15** |
| **Lab./Field Training Contents** | Water analysis (pH, Conductivity, hardness, Acidity, Alkalinity etc.).<br>**Case study/Project**<br>Case study/Project on water pollution, water conservation and water quality. | **30** |
| ***Keywords*** | ***Water, pollution, remediation techniques, water conservation, pH, hardness, acidity, alkalinity, conductivity, case study, project, water quality.*** | |

Dr. Sudipta

*Signature of Convener & Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended–***

1. *Dara, S. S., & Mishra, D. D. (2006). A textbook of environmental chemistry and pollution control. S. Chand Publishing.*
2. *Birdie, G. S. (2020). Water supply and sanitary engineering (10th ed.). Dhanpat Rai Publishing Company.*

***Reference Books Recommended–***

1. *Crittenden, J. C., Trussell, R. R., Hand, D. W., Howe, K. J., & Tchobanoglous, G. (2022). Stantec's Water Treatment: Principles and Design. John Wiley & Sons.*
2. *DE, A. K. (1990). Environmental Chemistry. Boca Raton, FL: CRC Press.*
3. *Edzwald, J. K. (2011). Water quality & treatment: a handbook on drinking water. New York, NY: American Water Works Association.*

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

- https://tmv.ac.in/ematerial/chemistry/kkr/SEM-6%20Hons-Green%20Chemistry.pdf
- https://www.ncbi.nlm.nih.gov/books/NBK83730/
- https://www.mdpi.com/2227-9717/11/12/3270
- https://www.epa.gov/waterutilityresponse/basics-water-remediation
- https://www.embibe.com/exams/conservation-of-water/

**Online Resources–**

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

## PART-D:Assessment andEvaluation

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

| | | |
|---|---|---|
| **Continuous Internal Assessment(CIA):** **(By Course Coordinator)** | 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**<br>**A. Performed the Task based on learned skill - 20 Marks**<br>**B. Spotting based on tools (written) – 10 Marks**<br>**C. Viva-voce (based on principle/technology) - 05 Marks** | **Managed by Coordinator as per skilling** |

***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/III/V** | Session: **2024-2025** |
| 1 | **Course Code** | **ICVAC-01T** | | |
| 2 | **Course Title** | **Corrosion in Industry** | | |
| 3 | **Course Type** | **VAC** | | |
| 4 | **Pre-requisite** (if,any) | ***As per program*** | | |
| 5 | **Course Learning. Outcomes(CLO)** | ➢ *To understand the types of corrosion in the industries.*<br>➢ *To understand the process of corrosion.*<br>➢ *To learn the adverse effect of corrosion.*<br>➢ *To learn the method of protection from corrosion.* | | |
| 6 | **CreditValue** | **2 Credits** | ***Credit = 15 Hours -learning & Observation*** | |
| 7 | **TotalMarks** | **Max.Marks:50** | **Min Passing Marks:20** | |

## PART -B: Content oftheCourse

**TotalNo.of Teaching–learning Periods(01 Hr. per period) - 30 Periods (30 Hours)**

| Unit | Topics(Coursecontents) | No.ofPeriod |
|---|---|---|
| I | Corrosion and its control :Introduction, Economic aspects of corrosion, Dry or Chemical Corrosion, Wet or electrochemical corrosion, Mechanism of Electrochemical Corrosion.Galvanic Corrosion, Concentration Cell Corrosion, Differential aeration corrosion, Pitting Corrosion, Underground orsoil corrosion, Passivity. | 08 |
| II | Factors Influencing Corrosion , Microbiological Corrosion, Atmospheric corrosion.<br>Corrosion Control :Proper designing, Usingpuremetal, Usingmetal alloys. Chemical conversion , Coating , Phosphating, Chromising, Treatment of metal surfaces, hot dipping , Use of inhibitors. | 07 |
| III | Protective coating: Introduction, Metallic Coatings, Various methods of cleaningarticles before electrode position, Electroplate and Electroplating methods.<br>Pretreatment of the surface, Metallic Coatings, Hot Dipping, Cementation or Impregnated Coatings, SprayedMetalCoatings, Cladding, Vapour Deposition. | 08 |
| IV | Paints : ingredients and their functions, Required Properties of a Paint, Paint Constituents andTheir Functions, Manufactureof Paint.<br>Types of Pigments, Characteristics of pigment, Uses in Paint Emulsion Paints, Paint Remover Varnishes.<br>ElectricalInsulating Materials: Dielectric properties, Requirements of anElectrical Insulating Material, Classificationof insulating material, Electrical Rigid Insulations. | 08 |
| *Keywords* | ***Corrosion, electroplating, galvanization, Paints, rusting .*** | |

*SignatureofConvener&Members (CBoS):*

## PART–C:Learning Resources

**Text Books, Reference Books and Others**

***Text Books Recommended –***

1. *Vedprakash. (2012).* Corrosion engineering *(3rd ed.). PHI Learning Private Limited.*
2. *Verma, G. S. (2016).* Metallic corrosion *(2nd ed.). Khanna Publishers.*

***Reference Books Recommended –***

*1. Rose Philo K.J. (1992). Inorganic Materials of Industrial Importance. New Delhi, India: Vishal Publishing Co.*

*2. Singh, R. K. (2010). Chemistry of Corrosion and Protection of Steel. Boca Raton, FL: CRC Press.*

*3. Jones, D. A. (1995). Principles and Prevention of Corrosion (2nd ed.). Upper Saddle River, NJ: Prentice Hall.*

*4. Baboian, R. (Ed.). (2005). Corrosion Tests and Standards: Application and Interpretation (2nd ed.). West Conshohocken, PA: ASTM International*

**Online Resources:**

- **http://nptel.ac.in**
- **http://swayam.gov.in**
- **http://epathshala.nic.in**

## PART-D:Assessment andEvaluation

**Suggested Continuous Evaluation Methods:**
**MaximumMarks: 50 Marks**
**ContinuousInternal Assessment(CIA):15 Marks**
**EndSemesterExam(ESE):35Marks**

| | | |
|---|---|---|
| **Continuous InternalAssessment (CIA):** **(By Course Teacher)** | Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks -**15** | Better marks out of thetwo Test / Quiz+obtained marks in Assignment shall be considered against **15** Marks |
| **End Semester Exam (ESE):** | **Two section – A & B** Section **A**: **Q1**. Objective – **05 x1= 05** Mark; **Q2**. Short answer type- **5x2 =10Marks** Section **B**: Descriptive answer type qts.,**1out of 2** from each unit-**4x05=20Marks** | |

***Name and Signature of Convener & Members of CBoS:***