

DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM & MARKING SCHEME

B.Sc. I, II, III, IV Semester
INDUSTRIAL CHEMISTRY
(Based on Choice Based Credit System)

SESSION : 2025-26



ESTD : 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE,
DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A⁺, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG (CG)



FOUR YEAR UNDERGRADUATE PROGRAM

Semester – I & II

COURSE CURRICULUM

B. Sc. INDUSTRIAL CHEMISTRY

For DSC/GEC

SESSION: 2025-26

**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	Pharmaceuticals	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		

Indira Prakash D. Singh Bhatia

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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: 2025-2026
1	Course Code	ICSC-01T	
2	Course Title	INDUSTRIAL TECHNOLOGY, METALLURGY AND SURFACE CHEMISTRY	
3	Course Type	DSC	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	➤ To explores the principles behind metal extraction and modification of crucial industrial materials. ➤ To gain expertise in unit operations like distillation, absorption, evaporation, filtration, and drying, essential for industrial chemical processes. ➤ To Analyze separation techniques and equipment selection ➤ To optimize industrial processes for efficient metal extraction and material production.	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Metallurgical Operations: [A] Basic metallurgical operations: pulverization, calcination roasting and refining. [B] Physico-chemical principles of extraction of Lead, Silver, Aluminium, Magnesium, Zinc, Chromium Ancient Indian Metallurgy: General Introduction of Ancient Indian Chemical Techniques- Metallurgy, Dyes, Pigments, Cosmetics- their production and uses. Chemistry of Ancient Metals- Gold, Silver, Copper, Iron, Tin, Lead and Mercury- their extraction and uses.		12
II	Inorganic materials of industrial importance: Their availability, forms, structure and modification. Alumina, Silica, Silicates, Clays, Mica, Carbon, Zeolites.		11
III	Chemical Technology - I [A] Distillation -Introduction: Batch & continuous distillation, separation of azeotropes, plate columns and packed columns. [B] Absorption - Introduction, Equipments - Packed columns, spray columns, bubble columns, packed bubble columns, mechanically agitated contractors.		11
IV	Chemical Technology - II [A] Evaporation -Introduction, Equipments short tube (standard) evaporators, forced circulation evaporators, falling film evaporators, climbing film (Upward flow) evaporators. [B] Filtration - Introduction, filter media and filter aids, equipments – plate and frame, filter Press, notch filter, rotatory drum filter, sparkler filter, candle filter, bag filter, and centrifuge. [C] Drying – Introduction, free moisture, bound moisture, Equipments, tray dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.		11
Keywords	Metallurgy, Ancient Indian Techniques, Extraction, Materials, Distillation, Separation, Processing		

Indira

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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:

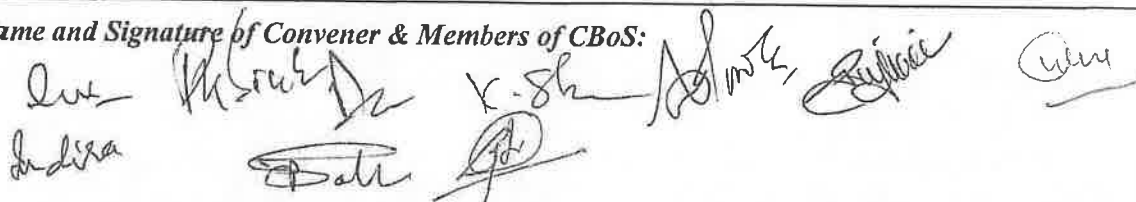
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

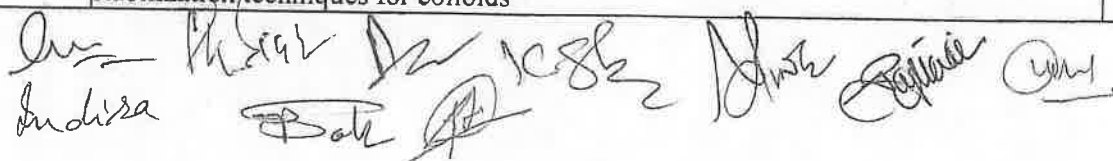
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 / 20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B	
	Section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

Name and Signature of Convener & Members of CBoS:



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

PART- A: Introduction			
Program: Bachelor in Science (Certificate / Diploma / Degree/Honors)		Semester - I	Session: 2025-2026
1	Course Code	ICSC-01P	
2	Course Title	INDUSTRIAL CHEMISTRY LAB. COURSE-I	
3	Course Type	DSC	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	➤ Identify potential safety hazards in a chemistry laboratory. ➤ Become familiar with common laboratory safety procedures and protocols. ➤ Learn about the appropriate Personal Protective Equipment (PPE) for various situations. ➤ Understand the importance of safe handling and disposal of chemicals.	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	Introduction to laboratory safety rules and regulations. Identification of common hazards in the lab, including: Flammable liquids, Corrosive chemicals Toxic substances, Electrical hazards, Glassware breakage, Demonstration and practice of safe laboratory practices Introduction to standard solutions and their applications. Distinguishing between primary and secondary standards with examples. Gravimetric preparation of a primary standard solution Standardization of a secondary standard solution Introduction to temperature measurement and the significance of accuracy. Explanation of the concept of calibration and its necessity. Calibration of a laboratory thermometer using a reference standard (e.g., mercury thermometer) at different temperatures. Preparation of buffers: Identifying suitable weak acids and conjugate bases for buffer preparation Selecting appropriate buffer components based on desired pH range Preparation Methods: Calculating the amounts of acid and conjugate base needed for buffer solutions Chromatography- Column Chromatography: Theory and applications of separation based on adsorption, partition, and size exclusion. Paper Chromatography: Principles of separation on paper media, visualization techniques, and applications. Thin Layer Chromatography (TLC): Introduction to TLC plates, solvent systems, development techniques, and applications Preparation of colloids: Dispersion methods for preparing colloids, Aggregation and stabilization/techniques for colloids		30


 Indira, Bal, [Signature], [Signature], [Signature], [Signature]

Keywords	Common Hazards, Toxic Chemicals, Standard Solutions, Calibration, Buffers, Chromatography, Colloids
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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., & Dhingra, S. (2005). College Practical Chemistry. Universities Press.
3. Kamboj, P. C. (2014). Advanced University Practical Chemistry (Part I). Vishal Publishing Co.
4. Pandey, O. P., Bajpai, D. N., Giri, S., (2013). Practical Chemistry, S. Chand.

Reference Books Recommended -

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

Online Resources-

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

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

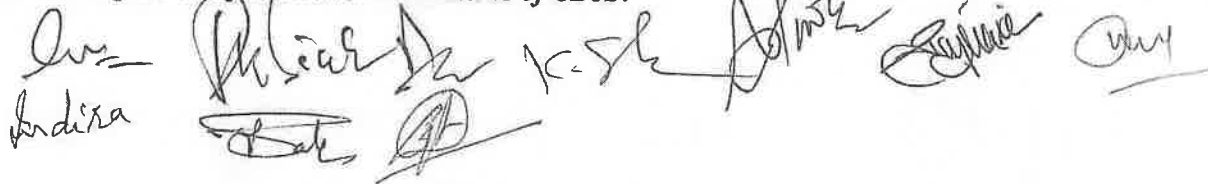
Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

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

Name and Signature of Convener & Members of CBoS:



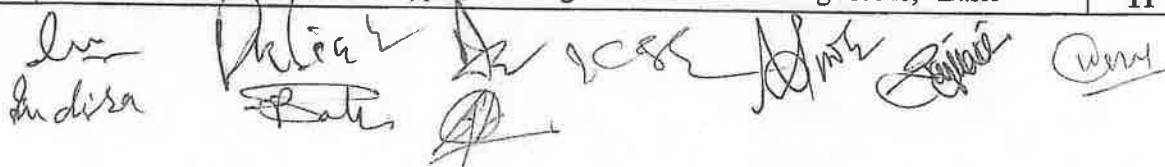
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF INDUSTRIAL CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science (Certificate / Diploma / Degree/Honors)		Semester - II	Session: 2025-2026
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. ➤ Evaluate the composition, refining processes, and applications of petroleum products and alternative fuels. ➤ Explain the principles and technologies involved in boiler operation, water treatment, and fluid flow systems. ➤ 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: [A] Fuel - Types of fuels, advantages and disadvantages, combustion of fuels, calorific value [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. [C] Coal: Types, structure, properties, distillation of coal, chemicals derived from coal	12
II	[A] Boilers 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. [B] Water Treatment Methods of Water Treatment: Pre-treatment methods: Sedimentation and filtration, Softening techniques (ion exchange, lime-soda process), Degasification Internal treatment methods: Boiler water conditioning with chemicals (blowdown, phosphate dosing)	11
III	[A] Fluid Flow: Fans, blowers, compressors, vacuum pumps, ejector. [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.	
	[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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

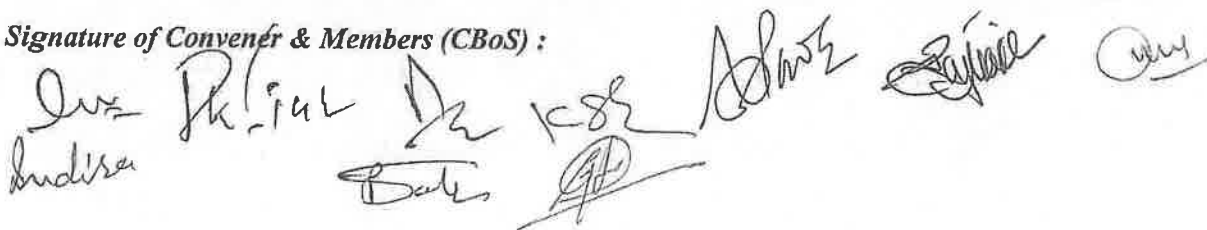
Name and Signature of Convener & Members of CBoS:

Indira K. S. [Signature] [Signature] [Signature] [Signature] [Signature] [Signature]

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: 2025-2026
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. ➤ Apply crystallization, distillation, and extraction methods in the laboratory for sample purification. ➤ Analyze boiling point diagrams and interpret data from physical constant measurements. ➤ 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, Distillation, Fractional Distillation, Boiling Point Diagram. Extraction Processes- Phase diagram, partition coefficient. Depression and elevation in B.P. /M.P. of solids and liquids. Ore analysis dolomite, limestone- calcite Analysis of alloys such as cupro-nickel. 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. Study, experiments/ demonstration experiments. 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 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 D. Performed the Task based on lab. work - 20 Marks E. Spotting based on tools & technology (written) – 10 Marks 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
Rohit
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DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG (CG)



FOUR YEAR UNDERGRADUATE PROGRAM

Semester – III & IV

COURSE CURRICULUM

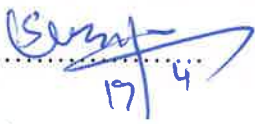
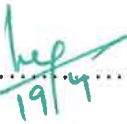
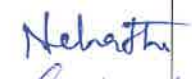
B. Sc. INDUSTRIAL CHEMISTRY

For DSC/GEC

SESSION: 2025-26

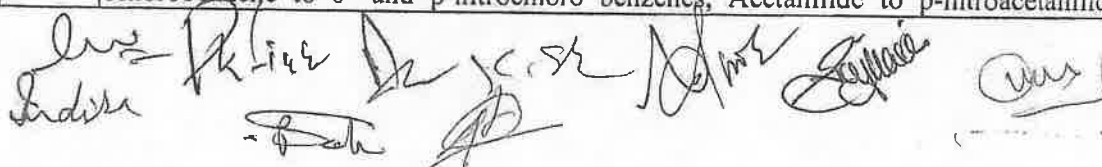
Syllabus has been approved for the session 2025-26

Name & Signature of Members of Board of Studies

Chairperson/H.O.D.....	 17/4	Departmental members:	
Subject Expert.....	 19/4		
(University Nominee)		Dr. Sunil Kumar	
Subject Expert.....	SL 19/4	Dr. Purna Khatun	
Subject Expert.....	 19/4	Dr. Soma Sen.	
Representative.....		Dr. Sushma Yadav	
(Industry) Representative.....			
(Alumni) Representative.....		Dr. Neha Jha	
(Professor Science Faculty Other Dept.)		Dr. Shalini Pandey	

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

PART-A: Introduction			
Program: Bachelor in Science		Semester-III	Session: 2025-2026
<i>(Diploma / Degree/Honors)</i>			
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. ➤ To understand polymeric material, glasses and composites, their properties, formation, crystallization, and structure with wide industrial applications. ➤ To understand unit processes in organic chemicals manufacture involving nitration, halogenations, chloro-compounds, sulphonation and mechanism of processes. ➤ 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: Mechanical properties of material and change with respect to temperature. Cement: Types of cement, composition, manufacturing process, setting of cement. Ceramic: Introduction, Types, Manufacturing process, Applications, Refractories.		11
II	Polymeric materials: Industrial polymer and composite materials, their constitution, chemical and physical properties, industrial applications. Glass: Types, composition, manufacture, physical and chemical properties, Applications. Corrosion: Various types of corrosion relevant to chemical industry - mechanism and preventive method.		11
III	Nitration: 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. Halogenation: 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: Introduction, sulphonating agents, chemical and physical factors in sulphonation. Mechanism of sulphonation reaction, Commercial sulphonation of benzene, naphthalene, alkyl benzene. Oxidation: 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, sulphonation, 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. Mineralogica. 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-booksand-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/>

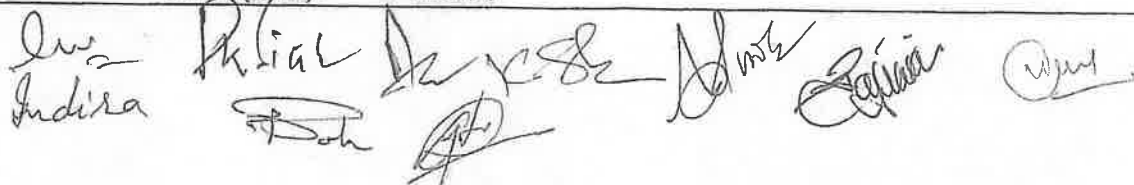
Part-D:AssessmentandEvaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100Marks

Continuous Comprehensive Evaluation(CCE): 30 Marks

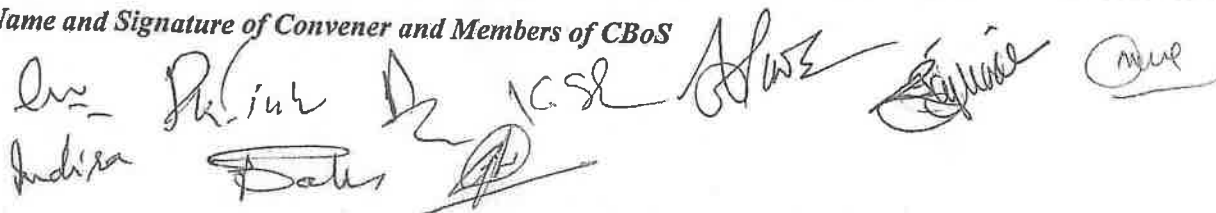
Semester End Exam(SEE): 70 Marks



 Indira, P. K. Lal, D. K. S. S., A. M. S., S. K. S., S. K. S., S. K. S.

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

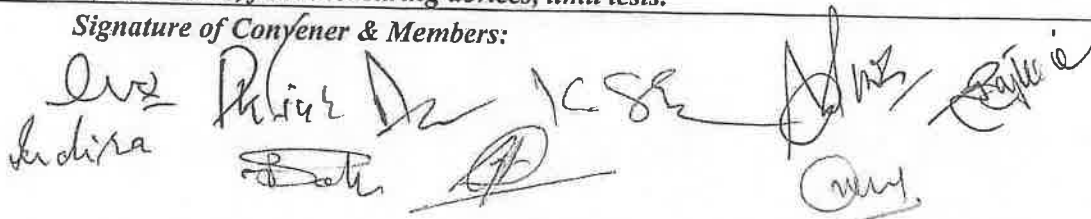


 Dr. Indira D. Bhatia

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: 2025-2026
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 As per Government norms	
5	Course Learning Outcomes(CLO)	➤ Understanding reactions with their mechanisms (e.g., nitration, sulphonation, Friedel-craft's reaction, etc.). ➤ Determination of flow control, flash point and ignition point. ➤ Understanding principles and working mechanisms of flow measuring devices. ➤ 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: One to two examples of each of the following: - Nitration, Sulphonation, Friedel-crafts reaction, Esterification, Hydrolysis, Oxidation, Halogenation, Chloro-Sulphonation, Reduction, Polymerization, Reaction of diazonium salts. PROCESS INSTRUMENTATION: Transducers of different types, use of Transducers for measuring flow control. Determination of flash point and ignition points of liquids. FLOW MEASURING DEVICES: Floats, Monographs of representative raw materials such as sulphuric acid, toluene, sodium carbonate, sodium hydroxide, carbon tetra chloride, benzoic acid (5-6 compounds). Limit Tests: 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 Conyener & 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-booksand e-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:

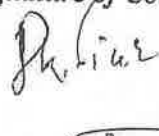
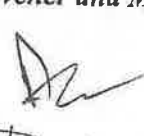
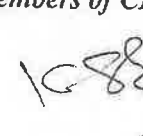
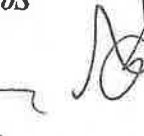
Maximum Marks: 50 Marks

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 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
Semester End Exam(SEE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. Status

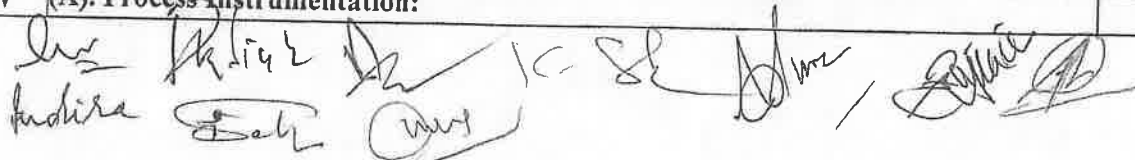
Name and Signature of Convener and Members of CBoS




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: 2025-2026
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 ➤ To understand aminolysis, aminating agents, amination reaction and their mechanism. ➤ To understand the concept of construction, principle and working of temperature and pressure measuring instruments. ➤ 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: 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. Alkylation: 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: 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. Hydrolysis: Introduction, hydrolyzing agents, mechanism of hydrolysis.		11
III	Amination 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. 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. Temperature: Glass thermometers, bimetallic thermometer, pressure spring thermometer, vapour filled thermometers, resistance thermometers, radiation pyrometers. Pressure: Manometers, barometers, bourdon pressure gauge, bellow type, diaphragm type pressure gauges, Macleod gauges, Pirani gauges, etc. (B) Liquid level: Direct-indirect liquid level measurement, Float type liquid level gauge, ultrasonic level gauges, bubbler system, density measurement, viscosity \ measurement. 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://uodiyala.edu.iq/uploads/PDF%20ELIBRARY%20UODIYALA/EL43/Introduction%20to%20Instrumentation%20Sensors%20and%20Process%20Control.pdf)
- <https://ecampusontario.pressbooks.pub/powerplantsystemsandcontrols/chapter/instrument-devices-level-measurement-and-control-2/>
- [https://mrctet.com/downloads/digital notes/ME/IV%20year/MAINTENANCE%20&%20SAFETY%20ENGINEERING%20DIGITAL%20NOTES.pdf](https://mrctet.com/downloads/digital%20notes/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

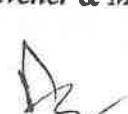
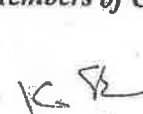
End Semester Exam (ESE): 70 Marks

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

Name and Signature of Convener & Members of CBoS:


Indira  

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

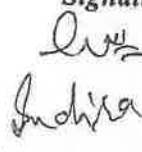
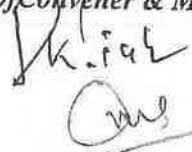
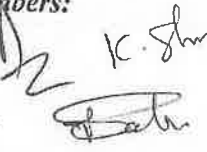
PART-A: Introduction			
Program: Bachelor in Science (Certificate/Diploma /Degree)		Semester-IV	Session:2025-2026
1	Course Code	ICSC-04P	
2	Course Title	INDUSTRIAL CHEMISTRY LAB. COURSE-IV	
3	Course Type	DSC	
4	Pre-requisite (if,any)	As per Program	
5	Course Learning Outcomes(CLO)	➤ To analyze the sample with different instruments. ➤ To develop understanding of material testing. ➤ To understand the working mechanism of instruments and different material characterization techniques. ➤ 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: Use of colorimeter, pH meter, Potentiometer, Conductometer, Refractometer, Polarimeter. MATERIAL TESTING-I: - Testing of alloys, Identification of plastics/rubber, estimation of yield point, Young's modulus, flaredness; Optical, Thermal, Mechanical and Electrical properties. MATERIAL TESTING-II: - Study of metallurgical microscope and sample preparation. Preparation and study of microstructure of cast Irons. Introduction to Nondestructive testing. WATER ANALYSIS: 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.	

Signature of Convener & Members:




PART-C

Learning Resources: Text Books, Reference Books and Others

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*. Vallabh Prakashan. Delhi, India.

Reference Books Recommended-

1. Clesceri, L. S. (1998). *Standard methods for examination of water and wastewater*. American public health 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.

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

- <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/espl6/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: 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
Semester End Exam(SEE):	Laboratory / Field Skill Performance: On spot Assessment G. Performed the Task based on lab. work - 20 Marks H. Spotting based on tools & technology (written) - 10 Marks 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:

Indira K. Shinde K. Shinde K. Shinde K. Shinde K. Shinde