

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)	<i>As per program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ 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	<i>Fuel Types, Combustion, Petroleum Refining, Alternative Fuels, Boilers, Water Treatment, Fluid Flow, Catalysis, Enzymes</i>	

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/asm-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:

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DEPARTMENT OF INDUSTRIAL CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree/Honors)</i>		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)	<i>As per program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ <i>Understand the theoretical principles behind various purification techniques.</i> ➤ <i>Apply crystallization, distillation, and extraction methods in the laboratory for sample purification.</i> ➤ <i>Analyze boiling point diagrams and interpret data from physical constant measurements.</i> ➤ <i>Perform basic experiments to detect food adulteration.</i> 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<i>Laboratory Techniques, Extraction, Ores analysis, Physical Constants, Food Adulteration</i>		

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

Pratik

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