

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

<b>PART- A: Introduction</b>			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree/Honors)</i>		Semester - II	Session: 2024-2025
1	Course Code	ICGE-02T	
2	Course Title	<b>INDUSTRIAL OPERATIONS, FUELS AND ASPECTS OF PHYSICAL CHEMISTRY</b>	
3	Course Type	GE	
4	Pre-requisite (if, any)	-	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> <li>➤ Analyze the properties, advantages, and limitations of various fuel types and their combustion processes.</li> <li>➤ Evaluate the composition, refining processes, and applications of petroleum products and alternative fuels.</li> <li>➤ Explain the principles and technologies involved in boiler operation, water treatment, and fluid flow systems.</li> <li>➤ Differentiate between homogeneous and heterogeneous catalysis, exploring their applications in industrial reactions and enzyme-mediated processes.</li> </ul>	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning &amp; Observation</i>
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	<b>Fuel Chemistry:</b> [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 <b>Methods of Water Treatment:</b> 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 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/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., 1out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:

Sudhira, [Signature], [Signature], [Signature], [Signature], [Signature]

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**COURSE CURRICULUM**

<b>PART-A: Introduction</b>			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree/Honors)</i>		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)	<ul style="list-style-type: none"> <li>➤ Understand the theoretical principles behind various purification techniques.</li> <li>➤ Apply crystallization, distillation, and extraction methods in the laboratory for sample purification.</li> <li>➤ Analyze boiling point diagrams and interpret data from physical constant measurements.</li> <li>➤ Perform basic experiments to detect food adulteration.</li> </ul>	
6	CreditValue	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	TotalMarks	Max.Marks:50	Min Passing Marks:20
<b>PART -B: Content of the Course</b>			
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. 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.		<b>30</b>
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 and Evaluation

### Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

<b>Continuous Internal Assessment (CIA):</b> (By Course Teacher)	Internal Test / Quiz-(2): <b>10 &amp; 10</b> Assignment/Seminar + Attendance- 05 Total Marks -15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against <b>15</b> Marks
<b>End Semester Exam (ESE):</b>	<b>Laboratory / Field Skill Performance: On spot Assessment</b> 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 [Signature] K. Shree [Signature] [Signature] [Signature]