

## Refinery Process Design

- 1.1 Course Number: CH382  
 1.2 Contact Hours: 3-0-0 Credits: 9  
 1.3 Semester-offered: 3<sup>rd</sup> Year-even  
 1.4 Prerequisite: Not Required

2. **Objective:** The detailed mathematical procedure followed in the process design of crude distillation tower will be taught extensively in this course. The importance of reflux system and the calculation of steam load for the operation of crude distillation column will be systematically discussed. Besides, the reactor design aspects of various catalytic processes commissioned in the refinery will be also covered in this course.

3. **Course Content:**

Unit wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Process Design Aspects of Crude Distillation Towers	Separation criteria in crude oil fractionation, Distillation Curves (TBP, ASTM & EFV), Temperature interconversion methods (TBP to ASTM, ASTM to TBP and TBP to EFV), Estimation of product properties	8
2	Calculation and Estimations in Crude Distillation Towers	Mass Balance (Tower & Flash Zone), Concept of over-flash and types of refluxes, estimation of flash zone, top, side, bottom, tray, Side-stripper products temperatures and steam requirement, Estimation of total condenser duty, Verification of fractionation criteria, Estimation of top and bottom condenser duty, Estimation of column diameter, Vacuum tower	19
3	Reactor Design Aspects	Major refinery processes (FCC/RFCC unit, hydroprocessing unit, Cat reformer unit)	4
4	Lube Base Oil Deasphalting Processes	Process Flow and Process variables	2
5	Solvent Refining of LOBS	Selection of Solvents, Operation Conditions and Solvent Recovery & Processing	2
6	Lube Refinery Economics and Advancements	Refinery economics and economic analysis, Advancements in Petroleum Refining Technologies	5

Total	40
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#### 4. Readings

##### 4.1 Text Books:

1. Watkins, R. N., *Petroleum Refinery Distillation*, 2<sup>nd</sup> Ed., Gulf, Houston, TX, USA, 1981.
2. David S.J. "Stan" Jones and Peter R. Pujado, *Handbook of Petroleum Processing*, Springer, The Netherlands, 2006.

##### 4.2 Reference Books:

1. Edmister, W. C., *Applied Hydrocarbon Thermodynamics*, 2<sup>nd</sup> Ed., Gulf, Houston, TX, USA, 1988.
2. Mohamed Fahim, Taher AL-Sahaf and Amal Elkilani, *Fundamentals of Petroleum Refining*, Elsevier, Oxford, 2010.

5. **Outcome of the Course:** After the successful completion of the course The students will have an knowledge on the importance of various distillation curves and their mathematical interconversion methods and, the estimation of various properties of crude products. They will also be able to perform step wise calculation procedure to calculate the crude distillation column diameter, critical design aspects of various catalytic reactors and various capital and operating costs involved in the refinery operations.