

# GUJARAT TECHNOLOGICAL UNIVERSITY

## CHEMICAL ENGINEERING (30) PETROLEUM REFINERY ENGINEERING SUBJECT CODE: 2713004 SEMESTER: I

**Type of course:** Chemical Engineering (ELECTIVE I)

**Prerequisite:** Basics of Organic Chemistry and General Chemical Technology fundamentals

**Rationale:** Crude Oil Refinery is the largest process industry in the Chemical sector in term of Quantum and eminence as it includes all the processes and equipments in the Chemical Industry. Some of the most difficult and tedious Unit Operations and process es is an inmate of Refinery section. The study of this subject will lead the students to gain specialized knowledge about a unique field in Chemical Engineering.

### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2	2	5	70	30	20	10	20	0	150

### Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introduction: A brief review of origin, exploration, drilling, transportation, storage and composition of petroleum. Petroleum products and their imp properties specifications and testing-TBP and other distillations.	6	11
2	Crude assay analysis, interconversion of distillation data, Nelson's Method, Mid percentage curve, Yield curve, Watkins method, Edmisters method, Packie's method and product blending	15	28
3	Process Design of Atmospheric Distillation Unit (ADU), heat and mass balance calculations for ADU and VDU, types of equipments used: columns, pumps tubestill heaters etc	10	18
4	Treatment of petroleum products, hydrodesulphurisation, hydrotreating, lube oil processing, deasphalting, dewaxing etc	7	13
5	Catalytic reforming, CCR (Continuous Catalytic Regeneration)Platforming	7	13
6	Advances in Fluidized Catalytic Cracking (FCC), feedstock properties of FCC, Thermodynamics, FCC Configuration, Material and Energy balance, Reactor-Regenerator FCC dynamic model	9	17

### Reference Books:

1. Nelson, W. L. Petroleum Refinery Engineering, Tata McGraw Hill publishing company, 1985
2. James H, Gary & Glenn E. Handwerk, ' Petroleum Refining, Technology & Economics' , 4<sup>th</sup> Edition, Marcel Dekker, Inc, 2001.
3. Speight, J. G. ,The Chemistry and technology of Petroleum , 5<sup>th</sup> Edition, M. Dekker, 1991.
4. Watkins, R. N., Petroleum Refinery Distillation, 2nd Edn., Gulf Pub. Co., Houston, Tex, 1979.

5. Fundamentals of Petroleum Refining, Taher A. Al- Sahhaf, Amal Sayed Elkilani, B. V. Elsevier, 2010.

**Course Outcome:**

After learning the course the students should be able to:

1. Understand the working of the Crude oil Refinery and all its subsidiary units.
2. Various operating conditions and major parameters for the processes carried out in the Petroleum industry.
3. Design of Refinery equipments and its auxiliaries

**List of Experiments (Any Five):**

1. To carry out ASTM distillation of Petrol/ Gasoline & convert those distillation data into TBP and Equilibrium Flash Vaporization (EFV).
2. To carry out ASTM distillation of Diesel & convert those distillation data to TBP and EFV.
3. Mathematical modeling of FCC Reactor-Regenerator model.
4. To find out important test properties of Gasoline/blends and compare it with actual data.
5. To find out important test properties of Naphtha and compare it with actual data.
6. To find out important test properties of Diesel and compare it with actual data.
7. To find out important test properties of Kerosene and compare it with actual data.
8. To find out important test properties of Lube oil and compare it with actual data.
9. To find out important test properties of Cycle stock/ Fuel oil and compare it with actual data.

**Open Ended Projects:**

The practical work at masters must be largely consisting of open ended projects. In each case a sample set may be provided and the faculty member may be empowered to select appropriate problems for practical work. At the end of semester before submission of marks of PA and term work, the faculty member will upload the three best problems done by the students during the practical hours.

The OEP in petroleum refinery engineering can include

- Collecting samples from different retail outlets, test their properties and compare them with the prescribed values and among themselves.
- Compare the properties of different grades of Petrol like Regular, Speed, Super petrol etc.
- Prepare a 3D layout of the entire Refinery starting from the Jetty to Retail market.

**Major Equipments:**

- Laboratory Distillation Columns
- Equipments for testing of petroleum products
- ASTM distillation apparatus.

**List of Open Source Software/learning website**

- NPTEL lecture series
- Literature available for Petroleum Refining
- MIT Open course lecture on Petroleum Refining.