



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Chemical Engineering

Subject Code: ME01030031

Subject Name: Advanced Petroleum Refining

w.e.f.Academic Year:	2024-25
Semester:	1
Category of the Course:	PEC

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 equipment in the Chemical Industry. Some of the most difficult and tedious Unit Operations and processes 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.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Explain the fundamentals and properties of petroleum and its products
02	Estimate crude assay analysis by different distillation methods.
03	Design of Refinery equipments and its auxiliaries.
04	Understand the different treatment methods of various petroleum fractions.
05	Explore fluid catalytic cracking considering all parameters

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial/Practical	
			ESE (E)		PA/ CA (M)	PA/CA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No.of Hours	% of Weight age
1.	Typical composition of petroleum, transportation and storage of petroleum and its product, Petroleum products- their important properties, specification and testing methods. TBP and other distillations.	10	23



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2.	Crude assay analysis, inter-conversion of distillation data, Nelson's Method, Mid percentage curve, Yield curve, Edmisters method and product blending	6	11
3.	Process Design of Atmospheric Distillation Unit (ADU), heat and mass balance calculations for ADU and VDU, types of equipment used: columns: thermally coupled ,divided wall and united wall, pumps tube still heaters	9	21
4.	Treatment of petroleum products, hydrodesulphurization, hydro treating, processing, deasphalting, dewaxingetc	7	15
5.	Catalytic reforming, CCR (Continuous Catalytic Regeneration) Platforming	7	15
6.	Advances in Fluidized Catalytic Cracking (FCC), feedstock properties of FCC, Thermodynamics, FCC Configuration, Material and Energy balance, Reactor-Regenerator FCC dynamic model	6	15
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
RLevel	ULevel	ALevel	NLevel	ELevel	CLevel
14	14	21	14	7	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) 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', 5th Edition, Marcel Dekker, Inc, 2001.
3. Speight, J. G., The Chemistry and technology of Petroleum, 5 th 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, AmalSayedElkilani, B. V. Elsevier, 2010.
6. The Petroleum Act, 1934. Professional Book Publishers, New Delhi.

(b) Open source software and website:

1. NPTEL lecture series
2. Literature available for Petroleum Refining



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3. MIT Open course lecture on Petroleum Refining.

Suggested Course Practical List:

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.

List of Laboratory/Learning Resources Required:

1. Laboratory Distillation Columns
2. Equipment for testing of petroleum products
3. ASTM distillation apparatus

Suggested Project List:

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

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