

<b>COURSE TITLE</b>	<b>REFINING TECHNOLOGIES</b>
<b>COURSE CODE</b>	<b>01CH1717</b>
<b>COURSE CREDITS</b>	<b>4</b>

**Objective:**

- 1 To study the petroleum refining technologies, their applications, and environmental aspects

**Course Outcomes:** After completion of this course, student will be able to:

- 1 Apply crude oil characterization methods to evaluate refinery feedstocks and products
- 2 Analyze cracking and reforming processes and product distribution
- 3 Analyze isomerization, alkylation, and polymerization processes for improved fuel quality
- 4 Evaluate environmental impacts and recommend pollution control in refinery operations

**Pre-requisite of course:** Basic knowledge of chemical engineering unit operation and processes

**Teaching and Examination Scheme**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
3	1	0	50	30	20	25	25

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Introduction</b> Composition of petroleum, laboratory tests, TBP and ASTM distillation curves, Overview of refinery feedstocks and products in configuring refinery operations, Basic refinery configuration Evaluation of crude oil properties and Design of crude oil distillation column, Furnace Design	8
2	<b>Cracking Process</b> Coking and Thermal process, Delayed coking; Catalytic cracking including FCC reactor-regenerator system, Cracking Feedstocks and reactors, Effect of process variables; Objective and application of catalytic reforming process reforming catalysts, Objectives & Hydrocracking Reactions, Hydrocracking feedstocks, Modes of Hydrocracking, Effects of process variables	10
3	<b>Isomerization, Alkylation and Polymerization</b> Isomerization process, reaction mechanisms, Effects of process variables, Alkylation process, Feedstocks, reactions, products, catalysts and industrial reactor systems, Polymerization: Objectives, process, Reactions, catalysts and effect of process variables	10

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
4	<b>Environmental issues and New Trends in refinery operations</b> Ecological consideration in petroleum refinery, Waste water treatment, control of air pollution, refinery energy efficiency, new trends in refinery, Alternative energy sources, Biodiesel, Hydrogen energy from biomass	10
<b>Total Hours</b>		<b>38</b>

#### Suggested List of Experiments:

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Tutorial 1</b> Determination of API gravity and basic crude oil property calculations	2
2	<b>Tutorial 2</b> Estimation of crude oil distillation fractions and column product distribution	2
3	<b>Tutorial 3</b> Basic heat duty calculation and efficiency analysis of refinery furnaces	2
4	<b>Tutorial 4</b> Comparison of thermal cracking and catalytic cracking processes	2
5	<b>Tutorial 5</b> Process flow analysis of delayed coking unit.	2
6	<b>Tutorial 6</b> Effect of operating parameters on catalytic reforming and hydrocracking	2
7	<b>Tutorial 7</b> Reaction pathways in isomerization, alkylation and polymerization	2
8	<b>Tutorial 8</b> Identification of major pollutants generated in petroleum refineries	2
9	<b>Tutorial 9</b> Case study on modern refinery technologies and sustainability practices	2
10	<b>Tutorial 10</b> Production routes of biodiesel and hydrogen as alternative fuels	2
11	<b>Tutorial 11</b> Strategies for improving refinery product yield and process efficiency	2
12	<b>Tutorial 12</b> Risk identification and safety management in petroleum refineries	2
<b>Total Hours</b>		<b>24</b>

**Textbook :**

- 1 Fundamentals of petroleum refining, Fahim, M. A., Al-Sahhaf, T. A., & Elkilani, A., Elsevier, 2009
- 2 Handbook of petroleum refining processes, Meyers, R. A., McGraw-Hill Education , 2004

**References:**

- 1 Springer handbook of petroleum technology, Springer handbook of petroleum technology, Hsu, C. S., & Robinson, P. R, Springer, 2017
- 2 Refining processes handbook, Refining processes handbook, Parkash, S., , Elsevier, 2003

**Suggested Theory Distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
<b>Remember / Knowledge</b>	<b>Understand</b>	<b>Apply</b>	<b>Analyze</b>	<b>Evaluate</b>	<b>Higher order Thinking / Creative</b>
0.00	0.00	35.00	35.00	30.00	0.00

**Instructional Method:**

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**Supplementary Resources:**

- 1 [https://digitalskills.iitmpravartak.org.in/course\\_details.php?courseID=83&cart=](https://digitalskills.iitmpravartak.org.in/course_details.php?courseID=83&cart=)