

**Subject Code: 09CH1503**

**Subject Name: Petroleum Refinery and Petrochemicals**

**Semester: 5<sup>th</sup>**

**Objective:** The aim of this subject is to impart the knowledge and develop the competency in the students to operate petroleum refinery and petro-chemical plant.

**Credits Earned:** 3 Credits

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

- 1) Demonstrate the knowledge of basics of petroleum refinery.
- 2) Demonstrate the concept of different properties of crude and petroleum products.
- 3) Explain the various types of processing of petroleum.
- 4) Demonstrate the concept of various treatment techniques of crude.
- 5) Explain the basics of petrochemical plant and manufacturing process of various petrochemical products.

**Pre-requisite of course:** Basics of Chemical Process Industries.

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	Mid Sem	Internal	Practical Exam	Term work	
2	0	2	3	50	20	30	25	25	150

**Contents:**

Unit	Topics	Contact Hours
1	<b>Basics of Petroleum and Refinery:</b> Present Scenario of Crude Oil Refinery, Importance, Occurrence, Origin (formation), Exploration, Composition, Classification and Evaluation of Crude oil, Composition of Petroleum, Classification of Petroleum. Refineries development in Gujarat and India, Classification of Refineries.	04
2	<b>Properties of Crude and Petroleum Products:</b> Primary treatment of crude : Dehydration and Desalting of crude oil , Various refinery products, Distillation of crude : Atmospheric Distillation, Vacuum distillation of crude residue , Different physical properties of fraction of petroleum such as Flash & Fire Point, Smoke Point , Aniline Point, Pour Point, Diesel Index, Octane Number Cetane Number etc. for Kerosene, Gasoline, Diesel etc., For Heavy Fractions like Lube Oil, Bitumen, Asphalt etc & their Important Properties such as Viscosity Index, Carbon Residue, Penetration Index, Softening Point etc.	08

3	<b>Processing of Petroleum:</b> Various types of cracking: Thermal cracking, catalytic cracking, Fluidised bed catalytic cracking and it's dependency on temperature and pressure, Reforming: purpose and discrimination between thermal and catalytic reforming, Platforming (Pt catalyst-Reforming), Other important refinery processes such as: Hydrotreating, Hydrocracking, Visbreaking.	06
4	<b>Treatment Techniques</b> Purpose and methods of sulphur removal : Doctor's sweetening, Catalytic desulfurization, Various Methods of Treatment of Lubes such as Clay Treatment, Phenol Extraction, Furfural Extraction, Dewaxing etc.	06
5	<b>Basics of Petrochemicals:</b> Development of petrochemical industry in Gujarat and in India, Manufacturing process of different compounds such as: (C1 Compounds) -Methanol Formaldehyde, (C2 Compounds)-Ethylene dichloride ,Vinyl chloride ,Ethylene Oxide, (C3 Compounds)-Polypropylene, Propylene oxide and Xylene.	04
<b>Total Hours</b>		<b>28</b>

- **References:**

**Text Books:**

1. B. K. Bhaskar Rao, Modern Petroleum Refining Processes, Oxford and IBH 2007 .
2. M Gopal Rao, Dryden's Outlines of chemical technology, 3<sup>rd</sup> Edition East West press pvt. Ltd, Delhi
3. B.K. Bhaskar Rao, A Text on Petrochemicals, 2<sup>nd</sup> Edition, Khanna Publishers, Delhi, 1998

**Reference Books :**

1. George Austin, Shreve's Chemical Process Industries, 5<sup>th</sup> Edition McGraw Hill publication –New Delhi.
2. W.L. Nelson, Petroleum Refinery Engineering, McGraw Hill, New York, 1958.
3. James H, Gary & Glenn E. Handwerk, Petroleum Refining, Technology & Economics, 4<sup>th</sup> Edition, Marcel Dekker, Inc, 2001.
4. Speight, J. G., The Chemistry and technology of Petroleum, 5<sup>th</sup> Edition, M. Dekker, 1991.
5. Watkins, R. N., Petroleum Refinery Distillation, 2<sup>nd</sup> Edition Gulf Pub. Co., Houston, Tex, 1979.

**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 and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
40%	40%	10%	10%	-	-

**List of Experiments:**

- 1) Determine flash point and fire point by Penskey Martin open and closed cup method.
- 2) Measure softening point and drop point of Grease
- 3) Measure Aniline point of Petroleum products.
- 4) Determine penetration number of Grease
- 5) Measure smoke point of kerosene
- 6) Measure cloud point lubricating oil
- 7) Measure Viscosity of lube oil by Redwood /Saybolt/Engler viscometer
- 8) Prepare a detail chart of petrochemical products
- 9) Prepare a detail chart of modern refinery
- 10) Determine Carbon residue by Ram's bottom method
- 11) Determine carbon residue by Conradson method

**Instructional Method:**

- a. 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.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory