COURSE TITLE	**PETROLEUM REFINING AND PETROCHEMICALS**
COURSE CODE	**01CH1710**
COURSE CREDITS	**4**

Objective:

1 To develop an understanding of crude oil characteristics, petroleum refining processes, petroleum product quality evaluation, and petrochemical production routes used in modern petroleum and chemical industries.

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

1 Explain the origin, composition, and classification of crude oil and evaluate its properties relevant to petroleum refining.

2 Analyze petroleum refining processes such as distillation, cracking, reforming, and hydro processing used in modern refineries.

3 Evaluate the quality parameters of petroleum products using standard laboratory testing methods.

4 Explain the production routes and industrial importance of major petrochemicals derived from petroleum feedstocks

Pre-requisite of course: Fundamentals of Chemical Engineering, Mass transfer

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Fundamentals of Petroleum and Crude Oil Characterization** Origin and formation of petroleum, composition of crude oil, sulfur compounds, nitrogen compounds, metals, salts and their impact on refining processes., Petroleum reserves and global distribution, classification of crude oils,, Crude oil characterization: API gravity, TBP curves, ASTM distillation, crude assay, PONA analysis, Watson characterization factor. Exploration, drilling & production, Transportation and storage of crude oil. , Refinery feedstock evaluation and crude oil selection, Pretreatment of crude oil: dehydration, desalting, and removal of impurities.	8

DR. DHARMESH HARESHKUMAR SUR
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)

Contents : Unit	Topics	Contact Hours
2	**Petroleum Refinery Operations** Overview of petroleum refinery configuration and refinery flow scheme. Crude oil distillation: Atmospheric distillation, Vacuum distillation, Fractionation principles. , Secondary conversion processes: Thermal cracking, Visbreaking, Delayed coking. Catalytic conversion processes: Fluid catalytic cracking (FCC), Catalytic reforming, , Hydrocracking, Catalytic alkylation, Catalytic isomerization, Catalytic Polymerization, Hydrotreating and hydrodesulfurization processes., Hydrogen management in refineries and Sulfur recovery processes.	12
3	**Quality Control of Petroleum Products** Classification of Laboratory test, Reid vapor pressure, ASTM distillation curve, Flash point and fire point, Octane number, Performance number, Cetane number, Aniline Point, Diesel Index, Calorific value, Smoke point, Char value, Viscosity index, Freezing point, Cloud Point and Pour Point, ASTM and BIS standards for petroleum testing., Composition, Properties and Production of Liquefied Petroleum Gases, Naphthas, Motor spirit, Kerosene, Aviation Turbine Fuels, Diesel fuels, Fuel Oils, Petroleum hydrocarbon solvents, Lubricating Oils, Petroleum waxes, Bitumen and Petroleum Coke	12
4	**Petrochemicals and Petrochemical Industry** Introduction to petrochemical industry and feedstocks. First-generation petrochemicals: Methane derivatives, ethylene, propylene, butadiene, aromatics (BTX), Second-generation petrochemicals: Ethylene oxide, vinyl chloride, formaldehyde, chloromethanes, synthesis gas derivatives. , Third-generation petrochemicals: Plastics, elastomers, synthetic fibres and resins., Production and applications of major polymers: Polyethylene, polypropylene, polybutadiene, styrene-butadiene rubber (SBR), and synthetic fibres	8
Total Hours		**40**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment 1** To determine Specific Gravity and API Gravity of given oil sample.	2
2	**Experiment 2** To determine of Flash and Fire point of given sample using Able's apparatus, Pensky-Martin apparatus, and Cleveland open cup apparatus.	2
3	**Experiment 3** To determine Aniline point of diesel sample and corresponding cetane index.	2

DR. DHARMESH HARESHKUMAR SUR
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
4	**Experiment 4** To determine Smoke point of kerosene sample using smoke point apparatus	2
5	**Experiment 5** To determine Cloud & Pour point of given oil sample.	2
6	**Experiment 6** To determine Viscosity using Redwood viscometer.	2
7	**Experiment 7** To determine Viscosity using Saybolt viscometer.	2
8	**Experiment 8** To determine Viscosity using Engler viscometer.	2
9	**Experiment 9** To determine Carbon Residue of given oil sample.	2
10	**Experiment 10** To determine the water content in Oil.	2
11	**Experiment 11** Determination of Saponification Value of Oil.	2
12	**Experiment 12** Determination of Acid Value of Lubricating Oil.	2
Total Hours		**24**

Textbook :

1 Modern Petroleum Refining Processes, Bhaskara Rao B. K., Oxford & IBH Publishing Co Pvt. , 2008

2 Petroleum Refining Technology, Edition -1, Dr. Ram Prasad, Khanna Publishers, 2025

References:

1 Petroleum Refining: Technology and Economics, Petroleum Refining: Technology and Economics, Mark J. Kaiser, James H. Gary, Glenn E. Handwerk, , CRC Press, , 2007

2 Introduction to Petrochemicals, , Introduction to Petrochemicals, , Sukumar Maiti, , Oxford & Ibh, , 2002

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					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
0.00	0.00	35.00	35.00	30.00	0.00

DR. DHARMESH HARESHKUMAR SUR
Digitally signed by (Name of HOD)

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Digitally signed by (Name of Dean/ Principal)

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://nptel.ac.in/courses/103105221