NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF PETROLEUM AND PETROCHEMICAL ENGINEERING
PETROCHEMICAL ENGINEERING PROGRAM

HC424 PETROLEUM REFINING PROCESSES I

I. GENERAL INFORMATION

CODE	**:**	HC424 – Petroleum Refining Processes I
SEMESTER	**:**	8
CREDITS	**:**	4
HOURS PER WEEK	**:**	5 (Theory–Practice)
PREREQUISITES	**:**	HC412 Physical Chemical Properties of Hydrocarbons PQ412 Thermodynamics for Chemical Engineering II
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

The course prepares the student in analysis of petroleum and gas properties, specifications, products and derivatives, understanding their importance in industry and society, as well as their effects on the environment. Students understand the operation unit present in the refining processes of crude oil and derivatives, analyze their optimal operating conditions (kinetics,.thermodynamics, physical and chemical conditions). Analysis of risk conditions and safety measures are presented and analyzed.

III. COURSE OUTCOMES

At the end of the course, students:

1. Learn the basics of the main processes that are used in oil refining, aimed at the production of fuels and special products.
2. Difference oil organic compounds and its derivatives, and analyze different transforming processes in the petrochemical industry.
3. Understand the importance of the oil industry as a component of the country's energy supply.
4. Know the operation units and the optimal operating conditions (kinetics, thermodynamic, chemical and physical) of petrochemical plants.
5. Analyze industrial methods and techniques for determining the characteristics of raw materials inputs and their refining processes.
6. Analyze the characteristics and specifications of crude oil and its derivatives.

IV. LEARNING UNITS

1. STAGES OF THE INDUSTRY AND CHEMISTRY OF HYDROCARBONS

Stages of oil and natural gas industry / Formation and composition of oil and natural gas / Types / Importance of hydrocarbons / Refining of petroleum and natural gas / Chemistry of hydrocarbons from oil and natural gas, fractions and finished products / Types of crudes. Classification / Impurity / Main features.

2. PETROLEUM CHARACTERIZATION

Characterization of petroleum and its derivatives / Properties / Methods of determination / Commercial combustion products: LPG, gasoline, kerosene, diesel, turbo, industrial oils / Special products: solvents, oils and grease, asphalt and petroleum chemical products / Physical and chemical characteristics of commercial products / Specifications / Domestic and industrial applications.

3. EVALUATION OF CRUDE AND NATURAL GAS

Evaluation of crude oil and natural gas / Evaluation of crude oil and its products / Applications of distillation curves: TBP, ASTM, flash vaporization / Use of tables, nomograms and correlations / Physical laboratory tests / Characteristic tests and analysis: distillation, API gravity and density, viscosity, vapor pressure, fluidity, corrosion, octane.

4. ANALYTIC TESTS

Testing analytical laboratory chromatography, metal content, content of paraffinic, naphthenic, olefin and aromatic mercaptans and total sulfide / Heat of combustion / Naphthalene. / Petroleum processing / Separation processes / Primary distillation process / Unit operations / Treatment and complementary processes / Operating conditions.

5. PROCESSES

Vacuum distillation process / Raw material products / Unit operations / Types of units / Operating conditions / Conversion processes / Fluid catalytic cracking / Commodity raw materials and products / Sections, treatments and complementary processes / Operating conditions / Desulphurization and catalytic reforming / Material and products / Conditions of operation / Presentation of technical reports.

6. PRODUCTION

Simple regression / Scatterplot / Parameter estimation / Decomposition of the total variance / Coefficient of determination / Estimation errors / Correlation coefficient / Prediction intervals / Tests of hypotheses of regression coefficients / Production of oils and lubricants gauzes, solid asphalt and liquid / Asphalt emulsions / Notions and general information about complementary conversion processes / Reduction of viscosity / Hydrocracking / Alkylation / Isomerization / Guided visit to La Pampilla refinery plant / Overview of refining in the country industry / Natural gas in the country, past present and future.

V. METHODOLOGY

The course takes place in theory and practice sessions. In theory sessions, faculty presents the concepts, processes, methods and P&ID of different operation units. In practice sessions, students solve diverse problems related to oil refinery are analyzed and solved. At the end of the course, students present and defend a project. Student's active participation is promoted.

VI. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (EP + EF + PP) / 3

EP: Mid-term Exam EF: Final Exam
PP: Average of Practical Works

VII. BIBLIOGRAPHY

1. P. WUITHIER.
   Petroleum, Refinery and Chemical Treatment. Prentice Hall, 2005.
2. W.L. NELSON.
   Petroleum Refining Engineering. Alfa Omega Ed., 2004.