HC412 – PHYSICAL-CHEMICAL PROPERTIES OF HYDROCARBONS

I. GENERAL INFORMATION

CODE	**:**	HC412 – Physical-Chemical Properties of Hydrocarbons
SEMESTER	**:**	7
CREDITS	**:**	4
HOURS PER WEEK	**:**	6 (3 Theory – 3 Laboratory)
PREREQUISITES	**:**	Thermodynamics for Chemical Engineering PQ321
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

The course prepares the student in the application of the concepts, methods and techniques of the evaluation of the physico-chemical characteristics of the products of crude distillation and the products of the fractionation of the natural gas, as well as it provides to the student an adequate manipulation, precise equipment and Instruments to obtain, calculate and report the properties of the products using standard laboratory tests (ASTM, ISO, NTP, among others).

III. COURSE OUTCOMES

At the end of the course, students:

1. Identify the type of crude to be used in the distillation.
2. Operates and manipulates standardized test equipment for petroleum products.
3. It makes use of standardized technical standards.
4. Analyze and characterize the products if they are in specification.
5. Observe safety regulations for handling flammable substances.
6. Participates in groups of students in laboratory experiments.
7. Wear personal protective equipment.
8. Write reports of your laboratory experiences.

IV. LEARNING UNITS

1. PROPERTIES / 6 HOURS

Distillation of an oil product in the laboratory / Determination of density of the fractions / Graph of the density curve.

2. DISTILLATION / 6 HOURS

Distillation plants / Distillation products / Commercial specifications / Standard tests / Definitions: Fractions or oil cuts / Distillation ASTM, Distillation ASTM curve / Density curve / Yield / Density: Definition Variation Of density with temperature / weighted average or gravimetric temperature.

3. TEMPERATURE AND DENSITY IN THE HYDROCARBONS

Graph weighted average temperature vs. Density of oil cuts / Distribution of cuts according to their chemical nature / Characterization factor Kuop / Representation of viscosity and molecular weight indices / Application exercises / Performance curves / ISO curves - properties / Physical-chemical properties Of hydrocarbons and fractions: Vapor pressure; Clayperon's equation: graphs / Application exercises.

4. CRITIC PROPERTIES / 6 HOURS

Critical properties: Of pure hydrocarbons; Of petroleum fractions / Variation of density with pressure and temperature: expansion coefficient / Application exercises / Compressibility factor

/ Thermal properties: specific heat, coefficient of adiabatic compressibility; Latent heat of vaporization, enthalpy / Application exercises.

5. VISCOSITY / 6 HOURS

Viscosity: Definition Kinematic viscosity. Dynamic viscosity. Viscosity of mixtures, viscosity index. Calorific Value: Definition Application Exercises / Octane Content: Definition / octane number of mixtures, lead susceptibility / Cetane Index / Explosive limits. / Determination of Hydrocarbons: Methods of absorption of gases with the apparatus ORSAT / Chromatography.

6. DISTILLATION CURVES / 12 HOURS

Distillation curves, True boiling points (TBP) Instant vaporization (FC) / Curve correlation / Application examples / Evolution of instantaneous vaporization (HR) curve with pressure / Focal point / Application examples / Phase properties Of equilibrium: density of the vapor phase and of the liquid phase. ASTM curves of the equilibrium phases / Activity properties of the TBP curve / Application example / TBP curves of the equilibrium phases / Application examples / Re vaporization with steam, Application of a distillation unit.

V. LABORATORY AND PRACTICAL EXPERIENCES

There are 4 qualified practices and 8 laboratory tests.

Laboratory 1: Introduction. Gravity API (ASTM D-1298).
Laboratory 2: Reid PVR vapor pressure (ASTM D-323) and Atmospheric Distillation (ASTM D-86).
Lab 3: Kinematic Viscosity and Viscosity Index (ASTM D-445).
Laboratory 4: Cetane Index (ASTM D-976) and (ASTM D-4737).
Laboratory 5: Copper sheet corrosion (ASTM D-130).
Laboratory 6: Water and sediment content (ASTM D-96).
Laboratory 7: sulfur (ASTM D-129) and calorific value (ASTM D-240).
Laboratory 8: Color (ASTM D-1500).

VI. METHODOLOGY

The course is developed in sessions of theory, practice and laboratory sessions. In theory sessions, the teacher presents concepts, standardized laboratory tests and applications. In practical sessions, various problems are solved and their
Solution. In laboratory sessions, specialized laboratory equipment is used to analyze the physicochemical characteristics of hydrocarbons. In all the sessions the active participation of the student is promoted.

VII. GRADING FORMULA

The “G” evaluation system is used. Calculation the Final Average:

FA = (ME + FE + AL) / 3

MP: Mid-term Exam. FE: Final Exam.
AL: Average of Laboratory and Practices.

VIII. BIBLIOGRAPHY

1. **WUITHIER, PIERRE** Oil, Refining and Chemical Treatment. Editorial Prentice Hall, 1971
2. **EDMISTER WAYNE C.** Properties of Hydrocarbons Applied Hydrocarbon Thermodynamics. Editorial D. Van Nostrand Company, 1991.