NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF PETROLEUM AND PETROCHEMICAL ENGINEERING

PETROLEUM AND NATURAL GAS ENGINEERING PROGRAM

HC322 – LABORATORY OF HYDROCARBONS

I. GENERAL INFORMATION

CODE	**:**	HC322 – Laboratory of Hydrocarbons
SEMESTER	**:**	6
CREDITS	**:**	3
HOURS PER WEEK	**:**	5 (2 Theory – 3 Practice / Laboratory)
PREREQUISITES	**:**	PQ223
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

The course provides, prepares, and illustrates the student in the application of the concepts, technical methods related to the behavior of oil and natural gas in the different stages of the hydrocarbon industry. The importance of the course is that it is the first course to determine the different physical and chemical properties of hydrocarbons and their management with awareness of the environment conservation.

III. COURSE OUTCOMES

At the end of the course, students:

1. Determine the maximum water content that is related to the cost of transport and storage by applying the standardized test methods to calculate the amount of water available and accepted at the point of inspection by running tests in the laboratory.
2. Rank the crude according to its API gravity. In a trading company, it accurately determines the API gravity of the oil and its derivatives to convert the volumes measured to volumes, at standard reference temperatures of 60ºF during the transfer, based on ASTM D1298 and Guide D 1250.
3. Calculate the kinematic viscosity of a crude, physical property that distinguishes heavy crude from light crude based on ASTM D 445. Measures the freezing point of the crude to give an approximate indication of its pumping possibility
4. Arrange the distillation equipment to distill a sample of crude that has been extracted from the reservoir, non-standardized method (Hempell Distillation)
5. Determines the sulfur content in the crude by determining the amount of SO2 formed by the combustion of a sample of a crude oil and taking into account that quantity to evaluate its prices, for this they are based on the ASTM D129 standard.
6. Determines the content of salts in the oil as it is important to determine the corrosion problems that can originate.
7. Characterizes the properties of dry natural gas using NTP standards.
8. Produces clear technical reports detailing the process by developing, interpreting results and formulating conclusions.
9. Applies theoretical knowledge acquired through experimental laboratory work.

IV. LEARNING UNITS

1. INTRODUCTION / 2 HOURS
Importance of the oil laboratory within the oil activity. Analysis of petroleum products. Standardization of tests. ASTM Standards. Procedure for drafting a standard. Physical Chemistry Tests, Laboratory Manual.

2. WATER AND SEDIMENT / 2 HOURS
Theory and practice of water and sediment analysis (BSW) Importance in the oil industry (BSW inspection), field sampling and oil engineering laboratory. Emulsions of water in petroleum.

3. API GRAVITY / 2 HOURS
API analysis of the oil and its demands of oil (types of gasoline, lubricating oils, residuals, etc.), mixtures of petroleum crude. Theory and correlations. Variations of gravity with temperature. Handling of the cake TAG. Various procedures comparisons and results at different scales.

4. VISCOSITY / 2 HOURS
Theory of dynamic and kinematic viscosity. Importance in the oil industry. Universal Saybolt Viscosity and Furoz Redwood. Formulas and graphics of ASTM standards. Results in the laboratory.

5. SULFUR
Theory and analysis of petroleum pollutants. Sulfur and its components. Action of Sulfur on oil. Pump method Parr. Other procedures (atomic absorption).

6. CORRELATIONS / 2 HOURS
Theory and analysis of the number of neutralization of crude oil and petroleum products. Importance in the oil industry. Correlation between N.N. And different APIs.

7. ANALYSIS OF ASPHALTENS / 2 HOURS
Theory and analysis of asphaltenes in the crude. Importance in the industry. Use of controlled reagents.

8. DISTILLATION / 2 HOURS
Theory and analysis of Robinson distillation. Classification of crude LCT and HCT, correlation curves. Characterization factor. Freezing point

9. SALT CONTENT / 2 HOURS
Theory and analysis of gas content in petroleum. Desalination. Equipment, laboratory methods for determination of salt content in the oil engineering laboratory.

10. TRAINING WATER ANALYSIS / 2 HOURS
Theory and analysis of water training. Importance in the oil industry. Salinity tests on salt books in 1000 barrels of crude oil. Theory and analysis of water formation alkalinity. Theory and analysis of water hardness training, analysis of methods in water formation.
Theory and special tests of crude oil. Viscosity FANN viscometer method for crude heavy correlations. Behavior at different temperatures.

V. PRACTICAL EXPERIENCES

1. **Determines the maximum water content in crude / 3 hours**
   Standard method for determining water in petroleum products and bituminous materials by distillation ASTM-4006 Standard method for determining Water and Sediments in Crude Oil by the centrifuge method ASTM-D4007
2. **Rank the crude according to its API gravity / 3 hours**
   Standard Test Method for the Determination of Density, Relative Density (Specific Gravity) or API Gravity of Petroleum and Liquid Petroleum Products by the Hydrometer MethodASTM-D1298-12b
3. **Measures the viscosity of a crude at different temperatures / 3 hours**
   Standard test method for determining the kinematic viscosity of clear and opaque liquids ASTM D 445-15, Freezing Point ASTM D 97

4. **Arrange the distillation equipment to distill a sample of crude that has been extracted from the reservoir / 6 hours**
   Standard Test Method for Distillation of Atmospheric Pressure Products ASTM D86 / Non-Standard Method (Hempell Distillation) / KUOP Characterization Factor
5. **Determines the sulfur content in crude / 3 hours**
   Standard Method for Determining the Combustion Heat of Liquid and Combustible Hydrocarbons by the ASTM D240 Calorimeter Pump, Sulfur in Petroleum Products (General Pump Method) ASTM D129
6. **Determines the salt content in raw / 3 hours**
   Standard test method for determination of salt content in crude ASTM D3230 and non-standard method, ASTM-D 664, Acid number in Petroleum products by potentiometric titration.
7. **NINETH LABORATORY.** Coradson Carbon Content in Petroleum Products ASTM D189, Test Method for Ash Determination in Petroleum Products ASTM D482, Standard Test Method for N Heptane Insolubles ASTM D3279.

VI. METHODOLOGY

The course is developed in hydrocarbon theory, practice and laboratory sessions. In theory sessions, the teacher presents concepts, theorems and applications. In the practical sessions, various problems are solved and their solution is analyzed. Laboratory sessions use ASTM standards to perform test methods and analyze their results. At the end of the course the student must present and present an integrating project or project. In all the sessions the active participation of the student is promoted.

VII. EVALUATION FORMULA

Evaluation system: G. The final average FA is calculated as follows:

FA = (ME + FE + AP + AL) / 4

ME: Mid-term exam FE: Final exam
AP : Average grade of practices (4).
AL: Average grade of laboratories (8).

VIII. BIBLIOGRAPHY

1. **WUITHIER, Pierre**
   The Petroleum Refining and Chemical Treatment
   Editorial Blume, 1971
2. **LLUCH URPI, José**
   Technology and Margin of Petroleum Refining
   Ediciones Diaz de Santos, 2008