NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING
GEOLOGICAL ENGINEERING PROGRAM

GE915 – PETROLEUM GEOLOGY

I. GENERAL INFORMATION

CODE	**:**	GE915 Petroleum Geology
SEMESTER	**:**	8
CREDITS	**:**	4
HOURS PER WEEK	**:**	5 (Theory–Practice–Laboratory
PREREQUISITES	**:**	GE213 Stratigraphy GE434 Petrology of Sedimentary Rocks
CONDITION	**:**	Compulsory
DEPARTMENT	**:**	Geological Engineering

II.SUMILLA DEL CURSO

The course prepares students for the study and analysis of the origin, occurrence, movement, accumulation and exploration of hydrocarbon fuels. Sedimentary basin analysis is carried out based on the following elements: source, reservoir, seal, trap, timing, maturation and migration. The characteristics and geological conditions of rock reservoirs, trappings and fluids are analyzed, as well as the geochemical analysis for hydrocarbon exploration. It is revised the petroleum geology in Peruvian hydrocarbon deposits in coast, Andean and jungle regions.

III. COURSE OUTCOMES

At the end of the course the student:

1. Understand the petroleum geological system: concepts, hydrocarbon basins formation and exploration
2. Recognize the evolution of organic matter in sediments.
3. Formulates exploration schedules of hydrocarbon fields.
4. Analyze the recovery of hydrocarbon from identified fields.

IV. LEARNING UNITS

1. PETROLEUM GEOLOGY

Petroleum and hydrocarbon industry / Hydrocarbons in the Geological Sciences / Natural resources / Energy: historical evolution of energy usage. Energy sources / History of the development of petroleum and natural gas industry in Peru and the world / Activities of petroleum industry: exploration and exploitation / Measurement units in the petroleum industry.

2. PETROLEUM

Petroleum forms as hydrocarbon / Composition, impurities and distillation / Physical states of hydrocarbons / Physical properties of petroleum relevant in geology: density or specific gravity, API classification, viscosity, fluorescence, solubility / Natural gas, occurrence in reservoirs, measurement units, composition and impurities, applications / Natural gas in Peruvian fields / Reservoirs classification / Occurrence and geological and geographic distribution of hydrocarbons. Occurrence modes: surface and underground / Surface occurrence: active forms (outcrop, volcanos, mudflow) and fossil or dead forms / Oil shale.

3. ROCK RESERVOIR

Rock origin and sedimentation environment (sea, continental) / Characteristics of rock reservoirs: porosity and permeability. Relations and factors affecting the characteristics. Thickness, productive interval and extension / Porosity and permeability in Peruvian fields / Hydrocarbon traps. Classification / Structural traps: characteristics, structural closeness (horizontal, vertical), classification, anticlinal principle, hydrodynamic traps, salt domes / Stratigraphic traps: primary and secondary. Exploration of stratigraphic traps. Structural-stratigraphic traps / Origin of petroleum. Historical synthesis: inorganic and organic theories. Evidences. Geologcal history of organic matter / Carbon cycle: photosynthesis. Preservation of organic matter / Organic matter in recent sediments and sedimentary rocks.

4. EVOLUTION OF ORGANIC MATTER IN SEDIMENTS

Main steps: diagenesis, catagenesis and metagenesis / Carbon and its relationship with petroleum and natural gas / Migration of petroleum from mother rock to rock reservoir: primary and secondary migration- Mechanisms. Importance of migration understanding for exploitation. Selective trappings / Water. Classification according to its origin: meteoric, connote and mixed. Classification according to the way of existing in nature: free, interstitial. Effects of interstitial water. Composition and chemical analysis of water. Origin of concentrated salt water. Analysis of water in Peruvian sites / Reservoir conditions: pressure and temperature. Pressure: measurements. Effects of increasing temperature / Heat sources, mechanisms of primary production: gas, water (marginal and deep). Gravity, rock expansion and combined impulsion fluid.

5. RECOVERY OF HYDROCARBON DEPOSITS

Characteristics and conditions / Hydrocarbon reserves in deposits: concept, computing. Methods: volumetric and matter balance. Reserves classes: in-situ, remainder, for evaluation: proven, probable and possible / Geochemistry in hydrocarbon exploration, concepts, samples for analysis, types of analysis, interpretation and applications. Lopatin method / Changes in petroleum composition: disturbance processes: thermal, asphaltic precipitation, bio-degradation, washing / Correlation between crude oil and generating rocks.

6. PETROLEUM SYNTHESIS

Hydrocarbon basins. Exploration schedules. Physiography and Peruvian geotectonical framework: Peruvian hydrocarbon basins: Andean, pericratonic, inter-mountains, Pacific coast / Revision of petroleum geology in Peruvian hydrocarbon deposits in coast, Andean and jungle regions.

VI. METHODOLOGY

This course is carried out in theory, practical and lab sessions. In theory sessions, the instructor introduces concepts, theorems and applications. In practical sessions, several problems are solved and their solution is analyzed. At the end of the course, students should hand in and expose an integrating paper and project. In all sessions, students' active participation is encouraged.

VII. 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 5 practical works

VIII. BIBLIOGRAPHY

1. Richard C. Selley
   Elements of Petroleum Geology, 2016
2. Le Roy, L. W.
   Subsurface Geologic Methods, 2015