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

PP323 – RESERVOIRS I

I. GENERAL INFORMATION

CODE	**:**	PP324 Reservoirs I
SEMESTER	**:**	6
CREDITS	**:**	5
HOURS PER WEEK	**:**	6 (Theory–Practice)
PREREQUISITES	**:**	PQ223 Physical Chemistry, PG311 Structural Geology
CONDITION	**:**	Compulsory
DEPARTMENT	**:**	Petroleum and Natural Gas Engineering

II. COURSE OUTCOMES

At the end of the course, students:

1. Know apply basic concepts of reservoirs engineering.
2. Determine gas and petroleum reserves.
3. Apply matter balance equation based on reservoir fluid volume and porous volume for both petroleum and gas reservoirs.
4. Apply different methods for predicting the behavior of reservoirs.
5. Carry out well declination analysis and POES computation through matter balance.
6. Determine the life of a reservoir, its behavior, production estimation.
7. Complete and analyze well formation tests.

III. LEARNING UNITS

1. GEOLOGY CONCEPTS

Geological cycle and time / Rock types / Reservoir main elements / Tramp types.

2. FLUID DISTRIBUTION

Porosity / Compressibility / Fluid saturation / Saturation indirect measurement / Electric properties / Porosity and resistivity relationships / Wetability and capillary pressure / Laboratory measurements / Semi-permeable membrane method / Interstitial saturation water / Centrifugal method / Mercury injection / Poral size distribution.

3. FLUIDS MOTION

Permeability / Horizontal, vertical and radial flow / Combination of permeable layers / Factors affecting permeability / Darcy law / Effective and relative permeability / Determination of relative permeability / Stationary method / Non-stationary method / Limitation of relative permeability concept / Correlations / Information and data translation: from laboratory to scale reservoir.

4. CLASSIFICATION OF RESERVOIRS BY THEIR PROPERTIES

Concepts of phases behavior / Simple and binary systems / Multicomponent systems / Compositional analysis / Gases and liquids / Gas properties / Ideal gases / State equation / Impurities / Deviation factor / Compressibility / Viscosity / Liquid state properties / Volumetric behavior / Density / Liquid mixtures / Reservoir samples / Laboratory analysis / Analysis of typical PVT / Black oil and volatile oil / Gas and condensates systems / Differential liberation and flash / Volume factor / Gas-petroleum relation / Multi-phase equilibrium / Equilibrium constant / Most used empirical correlations / Applications.

5. IN-PLACE VOLUMETRIC COMPUTATION OF HYDROCARBONS - RESERVES

Definition of resource and reserve / Computing methodologies / Structural planes and isophatic / Different methods of planimetry / Reserves classification.

6. MATTER BALANCE

Gas, gas-condensed and petroleum reservoirs /Under-saturated and saturated petroleum / In-situ determination of hydrocarbons / Havlena and Odeh methods / Predictive, conventional and non-conventional methods / Weighting average of diverse thrusts / Exploitation policies / Reservoir properties at final recovery / Limitations and errors of matter balance.

7. HYDRAULIC THRUST

Aquifers classification / Different types of behaviors / Transient, pseudo-steady state and steady state / Diffusivity equation / Superposition principle / Aquifer laws / Schilthuis, Hurst and Hurst-Van Everdingen / Individual and simultaneous determination of aquifer law in-place.

8. PRODUCTION FORECAST

Computing methodologies for different production stages / Analog methods / Montecarlo method / Typical well methodology / Declination analysis .

9. FORMATION PRESSUE TESTS

Concepts / Diffusivity equation / Test types / Analysis and interpretation.

10. NUMERIC SIMULATION

Most important methods / Simulation structure applying Reservoirs Engineering / Data selection and load / Result analysis and evaluation.

IV. METHODOLOGY

The course takes place in theory, practice and computer laboratory sessions. In theory sessions, the teacher presents concept, methods and applications. In practice sessions, various reservoir problems are solved and their solution analyzed. At the end of the course, students work in group to complete and defend the final project. Student's active participation is promoted.

V. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (EP + EF + PC) / 3

EP: Mid-term Exam EF: Final Exam
PC: Practical Work

VI. BIBLIOGRAPHY

1. T. AHMED
   Reservoir Engineering Handbook.
2. T. AHMED
   Advanced Reservoir Engineering.