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

PQ211 – QUALITATIVE CHEMICAL ANALYSIS

I. GENERAL INFORMATION

CODE	**:**	PQ211 – Qualitative Chemical Analysis.
SEMESTER	**:**	4
CREDITS	**:**	4
HOURS PER WEEK	**:**	6 (Theory–Practice-Laboratory)
PREREQUISITES	**:**	PQ122 Inorganic Chemistry
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

The course prepares students in the application of concepts, methods and techniques of qualitative chemical analysis for identifying the analytes, elements and compounds present in matter. Students analyze chemical reactions, their kinetics, outcomes, sensitivity, selectivity and specificity. Students also analyze the concepts of chemical equilibrium, ionic equilibrium, as well as oxidation and reduction chemical reactions. Electrolyte solutions and separation techniques are analyzed considering their ionic behavior and equilibrium (cations and anions). Laboratory experiences are carried out for cation separation and anion separation schemes.

III. COURSE OUTCOMES

At the end of the course, students:

1. Analyze and solve problems regarding the qualitative behavior of ions in chemical reactions.
2. Analyze the effects of catalysts in chemical reaction and processes.
3. Interpret the basic principles of chemical and ionic balances and use them for explaining the behavior of chemical reactions and, in general, of natural phenomena.
4. Carry out tests and experiments on the basic operations for ions separation.
5. Show interest, responsibility and sensitivity for preserving the environment formulating pollution-free chemical processes.
6. Work in team in all laboratory sessions and reporting.

IV. LEARNING UNITS

1. INTRODUCTION TO CHEMICAL ANALYSIS

Objectives and methods of analytical chemistry / Analytical chemistry definition / Sensitivity / Selectivity / Specificity / Limit of identification (LI) / Dilution limit (DL) / Cations / Anions.

2. CHEMICAL EQUILIBRIUM. PREDICTION OF REACTIONS IN SOLUTION

Concept of balance / Chemical systems and important reactions in the analysis / Non-ideal behavior of ions and molecules in solution / Activity / Activity coefficient / Ionic strength / Balance calculations.

3. ACIDS AND BASES

Equilibrium calculations / Buffer solutions / Tampons / Hydrolysis of salts / Weak polyprotic acid tampons / Ampholytes.

4. **OXIDATION AND REDUCTION**
   Definitions / Reactions REDOX type / Electrode potential / Hydrogen electrode potential / Cell thermodynamics / Applications.

5. **OXIDE REDUCTION AND ACIDITY**
   Predominant zone.

6. **COMPLEXES IN ANALYTICAL CHEMISTRY**
   Ion masking / Concentration / Successive complexes / Areas of dominance of different species

V. LABORATORY

Session 1: Cation separation I
Session 2: Cation separation II
Session 3: Cation separation III
Session 4: Cation separation IV and V
Session 5: Anion separation I
Session 6: Anion separation II
Session 7: Anion separation III
Session 8: Determination and separation of ions in a sample problem.

VI. METHODOLOGY

The course takes place in theory, practice and laboratory sessions. In theory, faculty present and analyze concepts and methods. In practice sessions problems related to different qualitative analytical methods are analyzed and solved. In laboratory sessions, students perform experimental tests and verify expected outcomes and results. After each laboratory experience, students submit a report describing procedures and summarizing results and conclusions. Student active participation promoted.

VII. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (EP + EF + PL) / 3

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

VIII. BIBLIOGRAPHY

1. F. BURRIEL, F. LUCERNA, S.
   Qualitative Analytic Chemistry, Ed. Prentice Hall, 2005.
2. GARY D. CHRISTIAN.
   Analytic Chemistry, Ed. Limusa, 2006