NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF SCIENCES
CHEMISTRY PROGRAM

CQ481 – INDUSTRIAL CHEMICAL PROCESSES

I. GENERAL INFORMATION

CODE	**:**	CQ481 – Industrial Chemical Processes
SEMESTER	**:**	7
CREDITS	**:**	05
HOURS PER WEEK	**:**	(Theory – Practices – Visits)
PREREQUISITES	**:**	CQ351 Physical-Chemistry III
CONDITION	**:**	Mandatory

II. COURSE DESCRIPTION

The course prepares the student in the basic preparation and understanding knowledge of national industrial technologies in flow diagrams. To know / apply the most common basic concepts of material balance in chemical processes at industrial scale, understand control parameters of the most important processes and operations related to the chemical industry, applying the principles of matter balance in steady state with and without chemical reaction in such national industrial processes as; the cement, glass, ceramics, mining-metallurgy, petroleum, brewing, and other industries.
Give the tools for solving research and development problems that occur in the chemical processes of industrial plants, integrating all the course content and being able to use them in the solution. We will complement the theoretical knowledge with visits to National industrial plants.

III. COURSE OUTCOMES

By the end this course the student will:

- Organize the initial data whose content is oriented to acquire dexterity in the understanding of technologies described in flow diagrams existing in the national industry.
- Acquire specific knowledge to each national industrial activity.
- Explain and apply materials balance to perform chemical quality control activities efficiently.
- Apply academic training in national industries to minimize the environmental impact associated with each different chemical activity.
- Be able to make a diagnosis of the chemical industries visited, contributing from the chemical point of view, for improvements in the quality control, in the reduction of waste and during the performance in the industry laboratories. The students will have the ability to implement improvements in the different activities entrusted.

IV. LEARNING UNITS

1. **MATTER BALANCE WITHOUT CHEMICAL REACTION (8 HOURS)**
   Techniques for the flowchart preparation / Concept of material balance / Materials balance without chemical reactions / Algebraic techniques / Humidification / Drying and evaporation processes (Distillation).

2. **MATTER BALANCE WITH CHEMICAL REACTION (8 HOURS)**
   Materials balance with chemical reactions / Basic definitions / Atom balance techniques / Reference substance / Processes with recirculation and purge.

3. **LAWS AND PARAMETERS IN CHEMICAL PROCESSES (10 HOURS)**
   Stages of the technological chemical process / Balance in technological processes / Speed of technological processes.

4. **MOST IMPORTANT INDUSTRIES OF ACID CHEMICAL PROCESSES (8 HOURS)**
   Production of Sulfuric acid / Production of Nitric acid.

5. **SILICON CHEMISTRY (8 HOURS).**
   Ceramic and non-metallic industries / Low temperature ceramics: bricks, tiles / High temperature ceramics: majolica and porcelain.

6. **HYDROCARBONS CHEMISTRY (4 HOURS)**
   Fats and oils industry.

7. **METALLURGICAL CHEMISTRY (12 HOURS)**
   Metallurgical industries / Electro-deposition and metal treatment industry / Metal extraction industry / Mineral flotation / Mineral bioleaching.

8. **PETROLEUM CHEMISTRY (4 HOURS)**
   Petroleum industries and other important / resins / paints / soaps / etc.

V. LABORATORIES AND PRACTICAL EXPERIENCES

WEEK 1 Introduction, Material balance without chemical reaction

WEEK 2 Diagrams of the Industrial Chemical Processes, Humidification, Distillation

WEEK 3 1st. QUALIFIED PRACTICE 1

WEEK 4 Drying, Thermodynamics in chemical processes.

WEEK 5 Laws of Thermodynamics in Chemical Processes

WEEK 6 Balance, Process Speed, H_2SO_4

WEEK 7 2nd. QUALIFIED PRACTICE 2.

WEEK 8 PARTIAL EXAM

WEEK 9 Fat and Oil Industries **/ VISIT**

WEEK 10 Pirometallurgy, Flotation **/ VISIT**

WEEK 11 3rd. QUALIFIED PRACTICE

WEEK 12 Biolixiviation - Petroleum Industry **/ VISIT**

WEEK 13 Balance in High Oven, Siderurgy **/ VISIT**

WEEK 14 4th. QUALIFIED PRACTICE

WEEK 15 Metallurgical Industries, Electrodeposition: Pb, Zn, Cu **/ VISIT**

WEEK 16 FINAL EXAM

WEEK 17 SUBSTITUTE EXAM

VI. METHODOLOGY

The course is developed in theory, practice sessions and visits to industrial plants. In the theory sessions, the teacher presents the concepts, laws of thermodynamics, the principles of chemistry exposed in the different activities of the different chemical industries, the active participation of the student is promoted.
This course will also apply the basic concepts of all courses taken in previous years to their undergraduate training and introduce the student to the knowledge of the technologies of each industry installed in the country, thus contributing to the optimization of quality control of the final and intermediate products and to give the guidelines for the prevention of environment pollution and the waste minimization of each national industry where it will be applied professionally.

VII. EVALUATION FORMULA

Calculation of the final grade (FG):

$$FG = \frac{1 * PE + 2 * FE + 1 * PA}{4}$$

PE: Partial Exam (Weight 1)
FE: Final Exam. (Weight 2)
PA: Practices Average (Weight 1)

To calculate the practices average:

$$\frac{QP_1 + QP_2 + QP_3 + L_1 + L_2 + L_3 + L_4 + L_5 + L_6}{9}$$

Out of the (04) Qualified Practices (QP) the one with the lower grade will be eliminated, and out of the (08) Laboratory Practices (L) the two with the lower grades will as well be eliminated.

VIII. BIBLIOGRAPHY

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- Fidel Missari A. “ Tecnología del oro” Centromin-Perú 1988
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- Mantell, C.L. “Ingeniería Electroquímica”, editorial Reverté S.A., España, 1980

- Mc Cabe, Warren L., Smith Julian C., Harriott Peter “Operaciones básicas de Ingeniería Química”, 4ta. Edición , McGraw Hill, Interamericana de España ,1999

- Murphy M. Regina “Introducción a los Procesos Químicos principios, análisis y síntesis” Ed. McGraw Hill Interamericana, México, 2010.

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- T.I.P “Moderna Tecnología del Petróleo” editorial Reverte, 2013