



NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF CHEMICAL AND TEXTILE ENGINEERING
CHEMICAL ENGINEERING PROGRAM

PI318 – CHEMICAL PROCESS INDUSTRY

I. GENERAL INFORMATION

CODE	: PI318 Chemical Process Industry
SEMESTER	: 7
CREDITS	: 5
HOURS PER WEEK	: 7 (Theory, Practice)
PREREQUISITES	: PI140 Transport Phenomena QU334 Organic Chemistry II
CONDITION	: Compulsory

II. COURSE DESCRIPTION

The course prepares students for the understanding and analysis of the most common and important chemical process in modern industry. Analyzed processes are water purification, industrial gases, cement industry, glass industry, ceramic industry, sulfuric acid industry, caustic soda and hydrochloric acid industry, ammonia and nitric acid industry, paints industry, soaps and detergents industry, synthetic and artificial fibers industry, plastic industry, alcohol, pulp and paper industry

III. COURSE OUTCOMES

At the end of the course, students:

1. Understand and analyze the steps of main industrial chemical processes: water purification, industrial gases, cement, glass, ceramic, sulfuric acid, caustic soda and hydrochloric acid, ammonia and nitric acid, paints, soaps and detergents, synthetic and artificial fibers, plastic, alcohol and pulp and paper.
2. Identify the components of industrial chemical process and analyze the factors affecting their performance.

IV. LEARNING UNITS

1. INTRODUCTION

Unit operations and process / Chemical technology / Construction materials / Measurement instruments / Data management instruments / Chemical control / Industrial safety / Laws and patents / Environmental pollution / Equipment of industry chemical processes

2. WATER SOFTENING AND PURIFICATION

Concepts, variables and parameters / Methods for water softening / Base change / Sewage treatment / Industrial waste-water treatment / Techniques of sea water desalination.

3. FUELS

Energy, energetic balance and fuels / Fuels classification depending on aggregation state / Most important solid, liquid and gaseous fuels / Industrial petroleum and other petroleum derivatives / Natural gas, water gas, blast furnace gas / Purification of gas fuels / Mineral carbon / Carbon ASTM classification / Carbon gasification / Peru carbon resources and uses.

4. INDUSTRIAL GASES

Oxygen / Nitrogen / Carbonic anhydride / Hydrogen / Acetylene / Synthesis processes / Industrial applications.

5. CEMENT INDUSTRY

Raw materials / Classification / Operations unit processes / Fabrication process of portland cement / Dry methods / Equipment / Cement setting.

6. GLASS INDUSTRY

Glass types / Raw materials / Fabrication process / Flat glass shaping / Glass bottles / Characteristics of glass products.

7. CERAMIC INDUSTRY

Raw materials / Unit process / Process phase diagrams / Fabrication of white products / Clay heavy products / Enamel and enameled metal / Refracting materials and furnaces used in ceramic industry.

8. SULFURIC ACID

Raw materials / Properties / Industrial use / Contact process using pure sulfur / Contact process based on sulfur rock roasting / Safety.

9. CAUSTIC SODA AND HYDROCHLORIC ACID

Caustic soda synthesis process / Hydrochloric acid synthesis process / Electrolysis of sodium chloride / Properties and industrial use of caustic sodium and hydrochloric acid / Other products: liquid chlorine, sodium hypochlorite, calcium hypochlorite, common salt, ferric chloride.

10. AMMONIA, NITRIC ACID AND NITROGEN SALTS

Fabrication process / Properties and industrial properties / Ammonium sulphate / Ammonium nitrate / Urea.

11. PAINTS, SOAPS AND DETERGENTS

Paints industry / Raw materials / Physical and chemical properties / Fabrication process / Plant distribution / Soaps and detergents industry / Raw materials / Fabrication process.

12. SYNTHETIC AND ARTIFICIAL FIBERS

Most important synthetic and artificial fibers / Raw materials and fabrication process / Nylon 66, polyester, cellulose acetate.

13. PLASTICS

Plastics industry / Classification / Thermoplastic resins / Thermo-stable resins / PVC / Bakelite,

14. ALCOHOL AND PAPER

Alcohol fabrication process / Sugar extraction process / Citric acid / Monosodium glutamate / Pulp and paper fabrication process from sugarcane bagasse.

V. PRACTICAL EXPERIENCES

Visits to the following industrial plants:

- Water purification plant
- Carbonated drinks plant
- Industrial gases plant
- Ceramic and refractories plant
- Flat glass plant
- Artificial portland cement plant
- Nitrogen fertilizer plant
- Paints plant
- Soaps plant
- Detergent plant
- Plastic plant

VI. METHODOLOGY

The course takes place in theory, practice and plant visit sessions. In theory sessions, faculty presents concepts, laws and applications. In practice sessions, various problems are solved and their solution analyzed. In plant visit session, students analyze diverse chemical process in actual plants around Lima city. At the end of each visit, students present a report summarizing main findings and conclusions. Student's active participation is promoted throughout the course.

VII. GRADING FORMULA

The Final Grade PF is calculated as follow:

$$PF = (EP + EF + PL) / 3$$

EP: Mid-term Exam.

EF: Final Exam.

PL: Average grade of Practice Works.

VIII. BIBLIOGRAPHY

1. NORRIS Shreve

Chemical Process Industries, McGraw Hill Editorial, 2008

2. KIRK Othmer

Chemical Technology, Utena Editions, Mexico, 2010.