



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

PA113 – METHODS ENGINEERING I

I. GENERAL INFORMATION

CODE	: PA113 Methods Engineering I
SEMESTER	: 7
CREDITS	: 4
HOURS PER WEEK	: 5 (Theory – Practice)
PREREQUISITES	: MA612 Statistics and Design of Experiments
CONDITION	: Compulsory

II. COURSE DESCRIPTION

This course trains students in the recognition of productive processes carried out in the different types of companies, in order to analyze the human work and prepare methods for improving the production and the productivity. Learning units: Enterprise, production systems, company productivity. Techniques for reducing the work content. Work study, method study. Process operation diagram. Process analysis diagram. Operation analysis and work methods improvement. Man-machine diagram and the operator's process. Station distribution. Study of motions. Rout sheet and ergonomics.

III. COURSE OUTCOMES

1. Analyze and assess the utilization of organizational resources of an enterprise. Learn the several production systems applied in enterprises. Get into the significance of organizational productivity. Study the ways of improving productivity.
2. Study the element defining the contents of a work, with emphasis in the human work. Analyze the work contents and management techniques for removing or minimizing the non-productive content.
3. Study every single of the 10 primary approaches that form part of the operations making up the execution of a work. Analyze every single of the approaches in order to obtain the removal or improvement or improvement of the operations making it up. Learn the principles and standards to deal with problems about material and objects manipulation in and work environment. Apply the techniques allowing to reduce displacements in a work environment seeking the best plant distribution.
4. Learn and apply graphic and quantitative techniques allowing to improve the job. Analyze lines of work in a productive center in order to manage a better equilibrium. Learn and analyze principles and laws of economy of motion. Study the ergonomics as factor related to the job. Study the fundamental operations made by an operator in his/her job, elaborate the diagram and apply technique that permit to improve it. Study the Therbligs to relate them with the operator's diagram. Learn the elaboration and application of the rout sheet.

IV. LEARNING UNITS

1. ENTERPRISE, PRODUCTION SYSTEMS, PRODUCTIVITY / 12 HOURS

Enterprise and production systems: principles of the concept of enterprise, types, industry classification, materials that enter and come out of the process, production systems.

Business productivity: productivity, types and characteristics, resources at the enterprise's disposal, systemic production, aggregate value, indicators of productivity. Symptoms of productivity problems in enterprises.

2. WORK CONTENT, WORK STUDY, METHOD STUDY / 12 HOURS

Basic content of work, factors increasing BCW. Techniques for reducing BCW: Reduction of work content inherent in the product, due to the process or the method, reduction of non-productive time attributable to the management and to the worker.

Work study: Definition, scope, objectives and usefulness, basic procedure for the work study.

Method study: Definition and purpose, basic procedure for the method study, selection, analysis and development of new methods, main activities, basic symbology.

3. GRAPHIC MEANS FOR THE METHOD ANALYSIS / 18 HOURS

Graphic means for the method analysis: general, Diagram for Process operation DPO: Agreements for its elaboration, use of the diagram, exercises. Diagrams for Process Analysis DPA: Agreements for its elaboration, use of the diagram, exercises. Flow diagram: generals, use. Workers displacement at the workshop: String diagram, flow graph, multiple activities diagram.

4. OPERATION ANALYSIS AND MATERIALS MANIPULATION, PLANT DISSPOSITION / 18 HOURS

Operation analysis: generals, the 10 primary reports, materials manipulation: principles, standards for facing manipulation problems, use of equipment. Factory disposition: definition, importance of the disposition according the industries, flow patterns, disposition according to activities, according to cost table, advantages and disadvantages.

5. MAN-MACHINE DIAGRAM / 12 HOURS

Man-machine diagram: general, elaboration and usefulness; Process diagram for a group or a team of operators, quantitative techniques for assessing the relationship man-machine. Operator's process diagram: general, elaboration of the diagram, utilization of the diagram. Therbligs of basic motions, the bimanual diagram.

6. STUDY OF MOTIONS / 6 HOURS

Study of motion: fundamental motions, definition of basic work divisions, Therbligs: principles and explanation of motion economy laws, use of the human body, disposition and conditions of the workplace.

7. EQUILIBRIUM OF LINES OF WORK, ROPUT SHEET AND ERGONOMICS / 12 HOURS

Equilibrium of line of work: general, balance of lines considering operators assigned to a unit, considering times assigned to operations, balance of lines of assembly, considering the formation of work stations; knowing the number of stations to be assigned work elements to themselves. Ergonomics. Work physiology, biomechanics, workplace design, human factors / Behavior, list of ergonomic check. Rout sheet: definition, elaboration.

V. LABORATORIES AND PRACTICAL EXPERIENCES

All theory sessions will be complemented with practical exercises about solved problems; as well as, lab work carried out at lab rooms and a final research paper.

VI. METHODOLOGY

Motivation, explanation, reflection and exemplification will be employed, as well as debates and dialogues about cases and presented topics; Applicative cases will be solved to reinforce teaching.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

$$PF = (PP + PL + EP + EF)/4$$

EP: Mid-Term Exam

EF: Final Exam

PP: Quizzes average

PL: Lab average

VIII. BIBLIOGRAPHY

1. **INTERNATIONAL WORK OFFICE, GENEVA**
Introduction to Work study (Spanish), 4th edition
2. **ROBERTO GARCÍA CRIOLLO**
Work Study, Methods Engineering (Spanish)
McGraw Hill Editorial, 2th edition (2009)