



Code: ING-IND 17

Credits: 6

Matter: Industrial plants

Main language of instruction: Italian

Other language of instruction: English

Teaching Staff

Head instructor

Prof. Luca Silvestri, PhD - luca.silvestri@unicusano.it

Introduction

The Industrial Plants course aims to provide the student with basic knowledge of industrial plants and the main problems associated with them. In particular, the student is offered the basic concepts regarding an industrial plant, the economic engineering elements necessary for strategic choices during production stage, the main methods used in the plant layout, the basic elements used for the sizing of a production system, the selection criteria in the use of manpower and finally the basic knowledge of the main topics concerning quality in production systems.

The main objective of the course is to provide the student with a complete overview of industrial plants and the basic knowledge to be able to deal with problems and critical issues connected to them and the student will be able to understand the most common problems that may arise in a production system, favoring a critical management engineering approach, according to an overall picture of the enterprise.

Objectives

The Industrial Plant course has the following training objectives:

1. Introduce the definitions and concepts underlying the study of industrial plants.
2. Explain the economics and accounting concepts used in industrial plants.
3. Explain the main methods used in layout design in a manufacturing system.
4. Illustrate the minimum elements necessary for sizing the production process.
5. Illustrate the essential foundations for designing a production system.
6. Provide an overview of the main concepts regarding the analysis of industrial investments.

Competencies:

Knowledge and understanding

At the end of the course the student will know all the elements necessary for determining the type and number of production factors for optimizing the sizing and design of the production system and for achieving company profit. Furthermore, the student will acquire the minimum knowledge of main tools for monitoring and required to achieve the continuous improvement of the processes themselves, both at the level of product output and for pursuing quality at the level of the entire enterprise.

Ability to apply knowledge and understanding

The student will be able to use the economic and engineering knowledge acquired in the choice of some factors in simple decision-making cases concerning the production system. The use of knowledge and understanding skills will

make it possible for the student to decide which are the optimal choices compared to those admissible in the different problems proposed by the course.

Autonomy of judgement

The student will be able to identify the most convenient solutions for the sizing of the production process, having the tools to decide in the strategic planning phase, the general characteristics of the industrial plant such as the type and production capacity up to the geographical positioning of the industrial plant. Subsequently, during the detailed design and sizing phase of the chosen production process, the student will be able to determine the minimum number of machines to be used, their optimal arrangement in the industrial plant, the number of shifts to plan for the workforce and how employ manpower among the different machines to be used, thus choosing the best solution both from an economic and management point of view.

Communication skills

For the topics proposed by the course, the student will be able to address the most common problems related to industrial plants in a critical manner, having acquired an overall vision of the most common problems related to business management.

Syllabus

Programme of the course:

Subject 1 – Introduction to industrial plants (3 video-recorded theory lessons and 1 video-recorded exercise lesson for a duration of approximately 11 hours - week 1) where the following topics are addressed: General information and classification of industrial plants, basic definitions of the course. Types of production systems: job-shop, flow-shop, intermittent and continuous, product-process matrix. Hints of rigid and flexible automation. Feasibility study. Location of an industrial plant: transportation cost method.

Etivity 1 – Application of the transport cost method in the case of Euclidean squared distance (6 hours of study load - week 1).

Subject 2 – Elements of economics and accounting in industrial plants (5 video-recorded theory lessons and 2 video-recorded exercise lessons for a duration of approximately 18 hours - week 1 and 2) where the following topics are addressed: The production function. Production costs: fixed costs, variable costs, semi-fixed costs, semi-variable costs, depreciation. Cost-volume-profit analysis: profitability diagram, break even point, contribution margin, gross margin, safety margin, elasticity. The financial statement.

Etivity 2 – Calculation of the main economic quantities (6 hours of study load - week 2).

Subject 3 – Layout of an industrial plant (3 video-recorded theory lessons and 2 video-recorded exercise lessons for a duration of approximately 13 hours - week 2 and 3) where the following topics are addressed: General information on the layout of an industrial plant. Methods for optimizing the arrangement of machines in the plant: transport cost method, traffic intensity matrix, centroid method, Buff triangle.

Subject 4 – Sizing of the production process (2 video-recorded theory lessons and 3 video-recorded exercise lessons for a commitment of approximately 25 hours - week 3 and 4) where the following topics are addressed: Cycle time, production capacity and throughput time. Availability, performance efficiency, quality rate, compound efficiency of a production system. Theoretical and real production capacity. Reliability and maintainability. Calculation of the minimum number of machines for single-product lines, for multi-product lines and for departments. Degree of utilization of the machines.

Activity 3 – Choice of number of shifts (6 hours of study load - week 2).

Subject 5 – Design of a production system (4 video-recorded theory lessons and one video-recorded exercise lesson for a commitment of approximately 20 hours - week 4 and 5) where the following topics are addressed: Push, pull and mixed production systems. Make to stock, make to order, assemble to order. Balance delay. Cycle time formulation. Pairing.



Subject 6 – The analysis of industrial investments (2 video-recorded theory lessons and one video-recorded exercise lesson for a commitment of approximately 37 hours - week 5 and 6) where the following topics are addressed: industrial investments. The analysis of profitability of investments. The analysis of profitability of investments.

Evaluation system and criteria

The exam consists of carrying out a written test aimed at ascertaining the ability to analyze and re-elaborate the concepts acquired and a series of activities (Etivities) carried out during the course in virtual classes.

The evaluation of Etivities from 0 to 3 points is carried out continuously during the duration of the course. The exam is evaluated for the remaining points from 0 to 27 and can be taken, in written form, both at the Rome office and at the teaching centers, upon reservation by the student.

The written test includes 2 exercises plus 2 theoretical questions. The 2 exercises are evaluated with an overall score of 20 points, while the score of each exercise varies with their level of difficulty. The theoretical question is evaluated up to 5 points. The total score achieved is reported in 27ths, to which the points obtained from the Etivities will be added (up to 3)

The expected learning outcomes regarding knowledge of the subject, the ability to apply it and independent judgment are evaluated by the exercises proposed in the written test and, in progress, by the Etivities, while the communication skills are evaluated by the theoretical question proposed in the written test .

Bibliography and resources

Materials to consult:

Teaching material

The teaching material on the platform, edited by the teacher, is divided into 6 modules. They cover the entire program and each of them contains handouts, slides and video lessons in which the teacher comments on the slides. This material contains all the elements necessary to study the subject.

Books:

A. Pareschi, "Impianti Industriali", Società editrice Esculapio, 2013.

D. Falcone e F. De Felice, "Progettazione e gestione degli impianti industriali", Hoepli, 2007.