



**Code: ING-IND/13**

**Credits: 9**

**Matter:** Mechanical system management and maintenance/Mechanical system design

**Main language of instruction:** Italian

**Other language of instruction:** English

## Teaching Staff

### Head instructor

**Dr. Fabio Giammei - [fabio.giammei@unicusano.it](mailto:fabio.giammei@unicusano.it)**

### Introduction

#### *1. Objective of the course :*

The course has the following educational objectives:

1. Define the basic concepts and logical phases of a mechanical system project
2. Illustrate some of the main useful tools for the design of a mechanical system
3. Explain some criteria for developing the project
4. Provide basic notions of reliability and maintainability of the mechanical systems
5. Evaluate the economic value of a mechanical system project

### Objectives

#### *2. Course Structure:*

The course is structured in three parts.

The first part presents a definition of the concepts associated with terms such as project, mechanical system, machine and life cycle and proposes an organic analysis of problems related to these concepts, commenting on the main logical and functional interdependencies.

In the second part the basic elements for the probabilistic approach necessary for the elaboration of the project are provided and tools of planning, theory of decisions and economic evaluation of design alternatives are explained.

The third part deals with some criteria according to which the design of a mechanical system can be developed. These include efficiency, stability, reliability, maintainability and quality, the latter intended not as a generic attribute of the system, but as a measurable characteristic

### Competencies:



### Knowledge and understanding

The student at the end of the course will know the principles necessary for the design of mechanical systems, even innovative ones. In particular, he will know the basic elements of statistics, decision theory, planning and stability. The student will also acquire the methods for the analysis of the reliability, maintainability and quality of the systems.

### Application of knowledge

The student will be able to use the knowledge of the design criteria for the analysis of the same and for the broad choice of the best design alternatives; it will also be able to develop analysis of the reliability and maintainability of the systems. Finally, he will be able to develop RAMS and FMEA / FMECA analyzes.

### Ability to draw conclusions

The student will be able to identify the best choices to develop the project, to plan the activities that make up the project and to develop comparisons between different economic alternatives.

### Communication skills

The student will be able to describe and support conversations on problems designing mechanical systems, their planning and general project management using appropriate terminology.

### Ability to learn

At the end of the course the student will have knowledge of the fundamental concepts necessary for the management and implementation of mechanical projects. All this will allow him to enter the world of work with greater maturity and will provide him with the basis to be able to have a general picture of the activities of a mechanical designer or a project manager.

## **Syllabus**

### *3. Programme of the course:*

#### **Subject 1 - Introduction**

The general elements of the course are introduced and in particular those of the first part of the course.

#### **Subject 2 - Definition**

The three main phases of the design of a mechanical system are analyzed in detail, namely the feasibility analysis, the outline project and the executive project.

#### **Subject 3 - Implementation**

Realization and automation, the automatic factory, economic motivations





**Subject 4 - Management and use**

Logistic support, the logistic support project

**Subject 5 - Tools for system design**

Research, calculation, design, planning, decision theory, economic evaluation of design alternatives

**Subject 6 - Statistical and probabilistic methods**

Elementary concepts, distribution functions, inference

**Subject 7 - Planning tools**

Analysis of a project in elementary activities, scheduling, graphical representation, series activities and activities in parallel, Gantt chart, notes on the PERT method

**Subject 8 - Decision**

Evaluation matrix of alternatives, decisions in conditions of certainty, decisions in conditions of risk, decisions in conditions of uncertainty

**Subject 9 - Evaluation economic criteria**

The model of economic flows, determination of economic equivalences, the economic value of a single alternative in conditions of certainty, economic comparison between different alternatives in conditions of certainty, economic assessments in conditions of risk and uncertainty, assessment of the break-even point (break-even point), profitability assessments

**Subject 10 - Criteria for the design of the system**

Efficiency, stability, reliability, maintainability, quality

**Subject 11 – Stability**

Resistance, deformation, duration

**Subject 12 - Reliability**

Reliability in the life cycle of the system, reliability measurement, reliability analysis, reliability logic, criteria to improve reliability, FMEA / FMECA

**Subject 13 – Maintainability**

Corrective maintenance, preventive maintenance, maintainability measurement, replacement, replenishment

**Subject 14 - Quality**



Quality measurement, quality design, type N tolerances, type S tolerances, type L tolerances, tolerance design

### **Evaluation system and criteria**

The exam consists of a written test consisting of a practical exercise and one or two theoretical questions. There is an activity (Eivity) carried out during the course.

The practical part is evaluated from a minimum of 0 to a maximum of 20 points and requires a reworking of the concepts of theory to be applied to a concrete case.

The theoretical part is evaluated from a minimum of 0 to a maximum of 10 points.

The evaluation of the Eivity is evaluated from 0 to 1 points.

### **Bibliography and resources**

#### *4. Materials to consult:*

Material on the platform that completely cover the program. This material contains all the elements necessary to deal with the study of the subject.