



## COURSE DETAILS

# "LABORATORY OF AUTONOMOUS VEHICLE DESIGN AND DEVELOPMENT"

SSD ING-IND/13 ING-IND/15

DEGREE PROGRAMME: AUTONOMOUS VEHICLE ENGINEERING (MOVE)

ACADEMIC YEAR 2022-2023

## GENERAL INFORMATION – TEACHER REFERENCES

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## GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: LABORATORY OF AUTONOMOUS VEHICLE DESIGN AND DEVELOPMENT

MODULE: CONCEPT DESIGN OF NEW VEHICLE

SSD OF THE MODULE: ING-IND/15

YEAR OF THE DEGREE PROGRAMME: II

SEMESTER: II

CFU: 6

## REQUIRED PRELIMINARY COURSES

none

## PREREQUISITES

basic knowledge of the Matlab/Simulink/Simscape environment

## LEARNING GOALS

*The module deals with the concept design of new autonomous vehicles covering advanced topics from new ideas to functional simulation. The module aims at providing students methods and tools for requirement engineering, definition of system architectures, concept generation, and concept selection. Starting from the design needs, the students will acquire the ability to: define functional and non-functional requirements; develop SysML diagrams using Visual Paradigm; define the requirements list using MATLAB Simulink Requirements; develop functional and logical architecture using MATLAB SySystem Composer; define and trace relationships among requirements and architectures; test and verify model performances against requirements using MATLAB Simscape; generate product concepts; select the promising product concept; design a concept for a new and innovative vehicle.*

## EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

### Knowledge and understanding

*The module provides students with knowledge and understanding of tools aimed to design a new vehicle concept starting from stakeholders' needs. The students need to know and understand problems related to the definition of the design context and the generation of new designing ideas.*

### Applying knowledge and understanding

*The module delivers ability needed to apply knowledge in practice, fostering the ability to use methodological tools to: (i) analyze a design problem; (ii) define, write, and implement requirements; (iii) develop functional and logical architectures of a system; (iv) define, implement and build relations among requirements, functional architecture, logical architecture; (v) verify system performances against the requirements by using physical models; (vi) select the best concept solution.*

## COURSE CONTENT/SYLLABUS

*[1 CFU] Introduction to product life-cycle. Product design and process development. Complex system development process. Concept design phase. International patent classification.*

*[2 CFU] Model-Based System Engineering (MBSE) approaches. SysML. Requirements Engineering. Functional and non-functional requirements. Rules for writing requirements. Requirement structure. Requirement definition. Black box and white box analysis.*

*[2 CFU] RFLP method. Development process. Requirements implementation. Functional architectures. Logical architectures. Tests and verifications.*

*[1 CFU] Systematic approaches to innovation. Methods and tools for concept generation and selection. Principle of Axiomatic design and Triz.*

## READINGS/BIBLIOGRAPHY

*Ullrich K. and Eppinger S. Product design and development, VI ed., Mc Graw Hill, 2016.  
Lecture notes available on the teachers' websites*

## TEACHING METHODS

*The teaching activities will be organized as follow:*

- a) Lectures for about 50% of the total hours;*
- b) Classroom practical exercises for about 10% of the total hours;*
- c) Project developing to further elaborate and apply knowledge for about 40% of total hours.*

## EXAMINATION/EVALUATION CRITERIA

### a) Exam type:

Exam type	
written and oral	
only written	
only oral	X
project discussion	X
other	

### b) Evaluation pattern:

The evaluation of the module is obtained according to the scores achieved by the student in the discussion of a project during the oral exam.

The final mark of the course Laboratory of Autonomous Vehicle Design and Development will be formulated by the Examination Committee as average of the judgments of the two modules that have equal weight.