# COURSE DETAILS

# " POWER AND PROPULSION SYSTEMS FOR UV"
# SSD ING-IND/08

DEGREE PROGRAMME: AUTONOMOUS VEHICLE ENGINEERING (MOVE)

ACADEMIC YEAR 2022-2023

## GENERAL INFORMATION – TEACHER REFERENCES

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## GENERAL INFORMATION ABOUT THE COURSE

YEAR OF THE DEGREE PROGRAMME: II
SEMESTER: II
CFU: 9

## REQUIRED PRELIMINARY COURSES

*none*

## PREREQUISITES

*none*

## LEARNING GOALS

*The course aims at providing students with advanced notions related to the design and management of the propulsion systems of ground unmanned vehicles. Notions cover the operation of powertrain components, and their integration with particular focus on energy efficiency and environmental impact.*

## EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

### Knowledge and understanding

*The course provides students with knowledge and basic methodological tools needed to analyze the operation of the propulsion system of unmanned vehicles, and the mutual interaction of its sub-components.*

### Applying knowledge and understanding

*The student needs to show ability to solve problems related to the design and optimal control of powertrain systems of unmanned vehicles. The course delivers ability and tools needed to apply knowledge in practice, favoring the ability to use methodological tools to design and control of the components of the powertrain systems, their optimal energy exchange, with the aim to maximize the energy economy.*

## COURSE CONTENT/SYLLABUS

*- Environment impact of transport sector and related legislation (0.5 CFU)*
*- Classification of powertrains for UV (0.5 CFU)*
*- Fundamentals of internal combustion engines and its thermodynamics (3,5 CFU)*
*- Basics of Fuel Cell in propulsion applications (1 CFU)*
*- Thermal/ electric hybrid systems (0.5 CFU)*
*- On board energy and power needs (1 CFU)*
*- Integration, configuration, and control of the power-train components (1 CFU)*
*- Numerical tools for powertrain control and management (1 CFU)*

## READINGS/BIBLIOGRAPHY

*J.B. Heywood, Internal combustion engine fundamentals, McGraw-Hill Education, 2018, ISBN: 9781260116106.*
*L. Guzzella, A. Sciarretta, Vehicle Propulsion Systems, Springer-Verlag Berlin Heidelberg, 2005, doi: 10.1007/3-540-28853-8.*
*A. Taghavipour, M. Vajedi, N. Azad, Intelligent Control of Connected Plug-in Hybrid Electric Vehicles, Springer International Publishing, 2019, doi: 10.1007/978-3-030-00314-2.*
*S. Onori, L. Serrao, G. Rizzoni, Hybrid Electric Vehicles, Springer-Verlag London, 2016, doi: 10.1007/978-1-4471-6781-5.*
*J. Pukrushpan, A. Stefanopoulou, H. Peng - Control of Fuel Cell Power Systems. Principles, Modeling, Analysis and Feedback Design. Springer, 2004, ISBN: 978-1-4471-3792-4.*

## TEACHING METHODS

*Teachers will use:*
*a) lectures for approx. 80 % of total hours;*
*b) practical exercises for approx. 15 % of total hours;*
*c) seminars 5%.*

## EXAMINATION/EVALUATION CRITERIA

**a) Exam type:**

| Exam type | |
|---|---|
| **written and oral** | |
| **only written** | |
| **only oral** | |
| **project discussion** | x |
| **other** | |

| | | |
|---|---|---|
| **In case of a written exam, questions refer to: (*)** | **Multiple choice answers** | |
| | **Open answers** | |
| | **Numerical exercises** | |

(*) multiple options are possible

**b) Evaluation pattern:**

*N.A.*