# SYLLABUS

## 1. Data about the program of study

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|---|---|---|
| 1.1 | Institution | Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Automotive Engineering, Mechatronics and Mechanics |
| 1.3 | Department | Automotive Engineering and Transports |
| 1.4 | Field of study | Automotive Engineering |
| 1.5 | Cycle of study | Master of Science |
| 1.6 | Program of study/Qualification | Advanced Techniques in Automotive Engineering - English |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 03.00 |

## 2. Data about the subject

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|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | | Auxiliary Internal Combustion Engine Components | | |
| 2.2 | Subject area | | | | Automotive Engineering | | |
| 2.2 | Course responsible/lecturer | | | | Assoc. Prof. PhD Eng. Nicolae Vlad BURNETE | | |
| 2.3 | Teachers in charge of seminars | | | | Assoc. Prof. PhD Eng. Nicolae Vlad BURNETE – nicolae.vlad.burnete@auto.utcluj.ro<br>Eng. Dorin Marius Stefan CAPATA - capata.fi.dorin@student.utcluj.ro | | |
| 2.4 Year of study | 1 | 2.5 Semester | 1 | 2.6 Assessment | E | | |
| 2.7 Subject category | Formative category | | | | | | DA |
| | Optionality | | | | | | DI |

## 3. Estimated total time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | 3 | of which | 3.2 Course | 1 | 3.3 Seminar | 0 | 3.3 Laboratory | 1 | 3.3 Project | 1 |
| 3.4 Total hours in the curriculum | 42 | of which | 3.5 Course | 14 | 3.6 Seminar | 0 | 3.6 Laboratory | 14 | 3.6 Project | 14 |

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| 3.7 Individual study: | |
| (a) Manual, lecture material and notes, bibliography | 20 |
| (b) Supplementary study in the library, online and in the field | 18 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 28 |
| (d) Tutoring | 14 |
| (e) Exams and tests | 3 |
| (f) Other activities | 0 |
| 3.8 Total hours of individual study (sum (3.7(a)…3.7(f))) | 83 |
| 3.9 Total hours per semester (3.4+3.8) | 125 |
| 3.10 Number of credit points | 5 |

## 4. Pre-requisites (where appropriate)

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| 4.1 | Curriculum | General knowledge about internal combustion engines. |
| 4.2 | Competence | Computer skills. |

**5. Requirements (where appropriate)**

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| 5.1 | For the course | Classroom with blackboard and projector. |
| 5.2 | For the applications seminar / laboratory / project | The attendance (100% presence) and the completion of the activities from the applications condition the admission to the final assessment. |

**6. Specific competences**

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| Professional competences | - Apply specific technical knowledge to describe and analyze the operation of internal combustion engine (i.c.e.) systems with respect to the design, build and use of road vehicles;<br>- Use adequate criteria and standard methods to evaluate internal combustion engines;<br>- Knowledge of parts, systems, installations and equipment currently in use in internal combustion engines;<br>- Ability to describe, explain and demonstrate their operation;<br>- Identify the components of auxiliary systems of an i.c.e.;<br>- Ability to perform case studies and simulation in order to identify the influences that different components have on the operation, performances and pollutant emissions of the i.c.e.;<br>- Develop competencies in a multi- and interdisciplinary environment;<br>- Develop a preliminary research report. |
| Cross competences | - Respect for the principles, norms and values of the professional conduct code by adopting a rigorous, efficient and responsible work strategy to solve problems and make decisions;<br>- Apply appropriate techniques to ensure good relations and effective team work in a multidisciplinary team, across hierarchies,<br>- Written and oral communication abilities in english and romanian;<br>- Communication (oral and written) in English and Romanian;<br>- Research, analysis and decision-making abilities;<br>- Respect for professional work ethics. |

**7. Discipline objectives (as results from the *key competences gained*)**

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|---|---|---|
| 7.1 | General objective | Develop specific competencies in the field of internal combustion engine auxiliary systems for professional growth. |
| 7.2 | Specific objectives | 1. Assimilating theoretical knowledge about auxiliary engine systems used in modern i.c.e.;<br>2. Understanding the role of auxiliary engine components and their integration in these systems;<br>3. Create a virtual model of the physical system to simulate its operation to highlight, understand and interpret its effects on the i.c.e. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. ICEs. Basics and future development | 2 | Presentations, discussions | |
| 2. Alternative fuels supply systems | 2 | | |
| 3. Aftertreatment systems for SIEs | 2 | | |
| 4. Aftertreatment systems for CIEs | 2 | | |
| 5. Charging systems | 2 | | |
| 6. Variable valve actuation | 2 | | |
| 7. Other ICE systems | 2 | | |

Bibliography
1. Robert Bosch GmbH, Bosch Automotive Handbook, Wiley, 2018
2. Van Basshuysen, R., Schaefer, F., Internal Combustion Engine Handbook, 2nd English Edition, SAE International, 2016
3. Mollenhauer, K., Tschöke, H., Handbook of Diesel Engines, Springer, 2010

| 8.2. Laboratory | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Presentation of the laboratories. Work safety notions | 2 | Presentations, applications | |
| 2. Analysis of the EGR system | 2 | | |
| 3. Analysis of charging systems | 2 | | |
| 4. Analysis of the SCR system | 2 | | |
| 5. Analysis of DPFs | 2 | | |
| 6. Analysis of START-STOP systems | 2 | | |
| 7. Recap and check of the laboratory work | 2 | | |

Bibliography
1. Burnete N., V., Iclodean C., D., Jurchiș, B., M., Motoare cu ardere internă. Procese și management motor, Ed. UTPress, 2021
2. ***Robert Bosch GmbH, Bosch Automotive Handbook, Wiley, 2018
3. ***AVL Boost Manuals
4. ***MTZ Worldwide

| 8.2. Project | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Presentation of project requirements | 2 | Presentations, applications | |
| 2. Discussion of scientific papers in the field of the project and of the approach | 2 | | |
| 3. Gather experimental data | 2 | | |
| 4. Presentation of an initial model | 2 | | |
| 5. Optimization of the model | 2 | | |
| 6. Discussion of results | 2 | | |
| 7. Final verification and presentation of the project | 2 | | |

Bibliography
1. ***AVL Boost Manuals
2. ***https://www.sciencedirect.com/
3. ***https://scholar.google.com/
4. Mariașiu, F., Iclodean, C., Aplicații numerice în simularea motoarelor cu ardere internă, UTPress, 2016

**9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field**

The accumulated competences are necessary for engineers working in research and developments, mechanical engineering etc. in the field of automotive engineering.

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | Theory and problem solving | Written evaluation. | 60% |
| 10.5 Seminars /Laboratory/Project | Appreciation of the work done during the laboratories | Check of the laboratory work and presentation of a research report | 40% |
| 10.6 Minimum standard of performance | | | |
| Identify and sketch the components of internal combustion engine systems<br>Describe the operation of internal combustion engine systems<br>Process the experimental data according to the laboratory requirements<br>Analyze the characteristics of internal combustion engine systems<br>Turning in a project that covers at least the following:<br>1. Formatting of the document according to the requirements<br>2. Introduction chapter with a short description of what has been done in this project, what where the objectives and the applied methodology<br>3. Literature review chapter on the selected topic<br>4. Internal combustion engine simulation chapter containing a presentation of the model input data, methodology and initial simulation results<br>5. Results and discussions chapter containing an analysis of the influences on engine performance, efficiency, and pollutant emissions<br>6. Conclusions chapter | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 21.03.2023 | Lecturer | Assoc. Prof. PhD Eng. Nicolae Vlad BURNETE | |
| | Teachers in charge of application | Assoc. Prof. PhD Eng. Nicolae Vlad BURNETE | |
| | | Eng. Dorin Marius Stefan CAPATA | |

| | |
|---|---|
| Date of approval in the department ……..<br>20.04.2023<br>_____ | Head of department<br>Prof.Ph.D.Eng. Barabás István |
| Date of approval in the faculty ……<br>11.10.2023_____ | Dean<br>Prof.Ph.D.Eng. Filip Nicolae |