

# COURSE SYLLABUS

## Test beds, measurement, and control basics

### 2023-2024

#### 1. Program information

1.1	Higher education institution	<i>Universitatea Națională de Știință și Tehnologie POLITEHNICA București, Centrul Universitar Pitești</i>
1.2	Faculty	<i>Mechanics and Technology</i>
1.3	Department	<i>Automobiles and Transport</i>
1.4	Field of studies	<i>Automotive Engineering</i>
1.5	Level of education	<i>Master</i>
1.6	Program / Qualification	<i>Automotive Engineering for Sustainable Mobility</i>

#### 2. Discipline information

2.1	Name of discipline		<i>Test beds, measurement, and control basics</i>	
2.2	Instructor of the lecture/course activities		<i>Adrian CLENCI</i>	
2.3	Instructor of the lab activities		<i>Adrian CLENCI</i>	
2.4	Year of the studies	<i>I</i>	2.5 Semester	<i>I</i>
	2.6 Type of evaluation	<i>E<sup>1</sup></i>	2.7 The discipline regime	<i>O, DAP<sup>2</sup></i>

#### 3. Estimated total time

3.1	Number of hours per week	<b>3</b>	3.2	lecture	<b>2</b>	3.3	lab	<b>1</b>
3.4	Total hours of the Academic Syllabus	<b>42</b>	3.5	lecture	<b>28</b>	3.6	lab	<b>14</b>
<b>Distribution of the time allocated to the individual study</b> (= Nb. of credits x 25 – Total hours of the Academic syllabus = 4 x 25 – 42 = 58 hours)								<b>ore</b>
Study by handbook, course support, bibliography and notes								<b>20</b>
Additional documentation in the library, on specialized electronic platforms and in the field								<b>15</b>
Preparation of seminars / laboratories, topics, reports, portfolios, essays								<b>15</b>
Tutorial								<b>4</b>
Examinations								<b>4</b>
Other activities...								
3.7	Total hours of individual study	<b>58</b>						
3.8	Total hours per semester (= 3.4 + 3.7)	<b>100</b>						
3.9	Number of credits allocated to the discipline	<b>4</b>						

#### 4. Prerequisites (where applicable)

4.1	Curriculum	-
4.2	Skills	<i>Mathematics, Physics, Mechanics, Numerical methods, Electrotechnics, Electronics and automatic systems, Vehicle dynamics, Thermodynamics, Automobile's construction, Fuel economy and environment protection, Testing and homologation</i>

#### 5. Conditions (where applicable)

5.1	for the lecture/course	<i>Classroom equipped with board, video projector, projection screen, computer</i>
5.2	for the lab	<i>Board, computer, lab equipments, test bench</i>

#### 6. Course goal(s)

6.1	The main goal of the discipline	<i>Development of competences in the field of Automotive Engineering by transmitting to the students the notions related to test beds, measurement, and control basics</i>
6.2	Specific goal(s)	<i>At the end of this course, the student should be able to discuss on this particular subject: the architecture of the test beds used to homologate an automobile, their control and measurements</i>

<sup>1</sup> E – Exam

<sup>2</sup> O – compulsory; DAP – deepening discipline

## 7. Contents

7.1. Lecture/course		No. of hours	Teaching methods	Remarks Resources used
1	Introduction: automotive industry and sustainable mobility; passenger cars homologation/type approval; legislative regulations regarding chemical pollution and CO <sub>2</sub> emission.	2	Lecture	Board, sketches, tables, graphs, sheets, photos, models, video projector, computer, internet
2	Prerequisites: International System of Units (SI); notions about energy balance; operating area of engine/motor; engine/motor performance	2	Exposure with support material	
3	Engine test bench: general layout; types; subsystems and operation; tests and results	4	Explanation	
4	Roller test bench (chassis dynamometer): general layout; types; subsystems and operation; tuning of the vehicle on the bench; road law; different tests and results	4	Description and exemplification	
5	Real Driving Emissions (RDE) via Portable Emissions Measurement Systems (PEMS): legislative packages; boundary conditions; validation criteria; pre-, main-, post-test; conformity factor	4	The heuristic conversation	
6	Measurement: data acquisition systems; types of signals; characteristics of sensors/transducers (pressure, temperature, flow measurement, gas analysis)	8	Debating	
7	Control basics: ON-OFF, PWM, PID, open and closed loop	4	Case study	
<b>TOTAL HOURS</b>		<b>28</b>		
7.2. Lab		No. hours	Teaching methods	Remarks Resources used
1	Engine test bench: operation, control and measurement	6	Explanation Description and exemplification	board, sketches, graphs, photos, models, computer, internet, lab equipment video projector
2	Roller test bench: operation, control and measurement (in collaboration with RTR)	2	The heuristic conversation	
3	RDE tests via PEMS (in collaboration with RTR)	4	Debating Case study	
4	Lab closure	2	Exercising Experiment	
<b>TOTAL HOURS</b>		<b>14</b>		
<b>Minimal bibliography:</b>				
Clenci A – Test beds. Support material				
Hughes, T.A. – Measurement and control basics, ISA, 2002				
Martyr, A.J., Plint, M.A - Engine testing. Theory and practice, Elsevier, BH, 2007				
Bonnick, A. – Automotive Science and Mathematics, Elsevier, BH, 2008				
Galindo, E - Chassis Dynamometer Testing, SAE International, 2017				

## 8. Corroboration the contents of the discipline with the expectations of the epistemic community representatives, professional associations and employers in the field related to the program

*The skills acquired in this discipline allow the graduates to work in the field of automotive engineering: design, calibration, test, validation, and homologation of passenger cars. Being a specialized discipline, its purpose is training the students, especially for engineering centers (design, research, development, innovation).*

## 9. Evaluation

Activity type	10.1 Evaluation Criteria	10.2 Evaluation methods	10.3 Percentage of the final grade
10.4 Course	Active involvement during the lectures	Questions / answers. Weekly recording	10%
	Good understanding of the treated subjects and the ability to analyze and synthesize	Written and oral exam	50%
10.5 Lab	Active involvement during the activity throughout the semester	Questions / answers. Individual discussions. Weekly recording	20%
10.6. Homework	Correct resolution. Quality of presentation	Oral presentation. Individual discussions	20%
10.7 Minimum standard of performance	<ul style="list-style-type: none"> <li>• handling of the units of measure involved in the specific parameters of the discipline</li> <li>• knowledge of the architecture of the test beds presented, of the basics of measurement and of the structure of the automatic control systems</li> </ul>		

Date (of filling)  
28.09.2023

Instructor (lecture/course)  
**Adrian CLENCI**, Professor

Instructor (lab)  
**Adrian CLENCI**, Professor

Date (of approval)  
29.09.2023

Director of supplying department  
**Helene ŞUSTER, ş.I.**

Director of beneficiary department  
**Helene ŞUSTER, ş.I.**