

# COURSE SYLLABUS

## Road Vehicle Dynamics

UP.02.DAP.1.O.21.03-AI

### 1. Program information

1.1	Higher education institution	University of Pitesti
1.2	Faculty	Mechanics and Technology
1.3	Department	Automobiles and Transport
1.4	Field of studies	Automotive Engineering
1.5	Level of education	Master
1.6	Program / Qualification	Automotive Engineering for Sustainable Mobility

### 2. Discipline information

2.1	Name of discipline		Road Vehicle Dynamics					
2.2	Instructor of the lecture activities		TABACU Ștefan					
2.3	Instructor of the lab activities		NEAGU Elena					
2.4	Year of the studies	I	2.5 Semester	I	2.6 Type of evaluation	E	2.7 The discipline regime	O

### 3. Estimated total time

3.1	Number of hours per week	3	3.2	lecture	2	3.3	lab	1
3.4	Total hours of the Course syllabus	42	3.5	lecture	28	3.6	lab	14
<b>Distribution of the time allocated to the individual study</b>								<b>ore</b>
Study by handbook, course support, bibliography and notes								20
Additional documentation in the library, on specialized electronic platforms and in the field								20
Preparation of seminars / laboratories, topics, reports, portfolios, essays								10
Tutorial								4
Examinations								4
Other activities .....								
3.7	Total hours of individual study	58						
3.8	Total hours per semester <sup>2</sup>	100						
3.9	Number of credits allocated to the discipline	4						

### 4. Prerequisites (where applicable)

4.1	Curriculum	Not applicable
4.2	Skills	Mathematics, Mechanics, Internal Combustion Engines

### 5. Conditions (where applicable)

5.1	for the lecture	Classroom equipped with board, video projector, projection screen, computer
5.2	for the lab	Board, computer, lab equipments

### 6. Specific skills acquired

Professional skills	Application of the principles and methods of the exact sciences and of nature in the construction of physical-mathematical models for simulating the functioning of vehicles. Use of appropriate criteria and methods to identify the correspondence of concepts, theories, and models in the field of automotive engineering with the real systems to which they refer. Developing professional projects by the consistent use of theories and methods specific to road vehicles.
transversal skills	Execution of professional tasks according to the specified requirements and within the required deadlines, following a predetermined work plan and under qualified guidance. Easy integration within a group, assuming specific roles and achieving good communication in the group. Achieving personal and professional skills and efficient use of their own resources and modern study tools.

### 7. Course goal(s)

7.1	The main goal of the discipline	The general objective of the discipline is to improve the knowledge in the field of vehicle dynamics.
7.2	Specific goal(s)	Describe, explain and calculate the forces acting between the tire and the road during the operation of a vehicle; Identify and verify vehicle function requirements for maneuvers that mainly are either of longitudinal, lateral, and vertical. Describe design and basic function of the vehicle systems: propulsion, brake, and steering.

### 8. Contents

8.1. Course		No. hours	Teaching methods	Remarks Resources used
1	Introduction. Short history. Vehicle dynamics.	2	- Lecture	board, sketches, tables, graphs, sheets, photos, models, video projector, computer, internet
2	Tires. Tire construction. Tire Size and Load Rating. Terminology and Axis System.	2	- Exposure with support material	
3	Mechanics of force generation. Tractive properties. Cornering properties. Camber thrust. Aligning moment. Combined braking and cornering. Conicity and ply steer. Durability forces. Tire vibrations.	8	- Explication - Description and exemplification	
4	Road loads. Mechanics of Air Flow Around a Vehicle. Pressure Distribution on a Vehicle. Aerodynamic Forces. Drag Components. Drag Coefficient. Drag. Crosswind Sensitivity. Rolling resistance. Factors Affecting Rolling Resistance. Typical Coefficients.	6	- The heuristic conversation - Debate - State the problem - Exercise	

	Total road loads. Fuel Economy Effects.			
5	Dynamic axle loads. Static loads on level ground. Low-speed acceleration. Loads on grades.	2		
6	Power-limited acceleration. Engines. Power Train. Traction-limited acceleration. Traction Limits.	4		
7	Braking performance. Stopping distance. Time to stop. Deceleration with wind resistance. Braking forces.	4		
<b>TOTAL HOURS</b>		<b>28</b>		

<b>8.2. Lab</b>		<b>No. hours</b>	<b>Teaching methods</b>	<b>Remarks Resources used</b>
1	Principles of vehicle layout.	2	- Lecture - Exposure with support material - Explication - Description and exemplification - The heuristic conversation - Debate - State the problem - Exercise	<i>board, sketches, tables, graphs, photos, models, computer, internet, lab equipment for the investigation of tire behavior under static loads; lab equipment for the evaluation of friction coefficient.</i>
2	Tire construction.	2		
3	Tire behavior under static loads.	2		
4	Investigation of the contact patch between the tire and the road.	2		
5	Investigations on the friction coefficient between the tire and the road.	2		
6	Vehicle function requirements for maneuvers that mainly are either of longitudinal, lateral, and vertical	4		
<b>TOTAL ORE</b>		<b>14</b>		

**Minimal bibliography:**

1. Tabacu, S, lecture notes;
2. Tabacu, S, Tabacu, I., Macarie, T., Neagu E, Dinamica autovehiculelor, Editura Universității din Pitesti, 2004;
3. Ghiulai, C., Vasiliu Ch, Dinamica autovehiculelor, Editura Didactică si Pedagogică București, 1975;
4. Milliken, W., Milliken, D, Race car vehicle dynamics, SAE Inc, 1995;
5. Hans Pacejka, Tire and Vehicle Dynamics, Elsevier, 2012;
6. Wong, J.Y., Theory of ground vehicles, John Wiley & Sons, 1978;
7. Thomas D Gillespie, "Fundamentals of Vehicle dynamics", SAE USA 1992;
8. Happian-Smith, J., An Irtroduction to the Modern Vehicle Design, SAE International, 2002

**9. 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, homologation of thermal engines and automobiles. Being a specialized discipline, its purpose is to training students, especially for engineering centers (design, research, development).*

**10. Evaluation**

<b>Activity type</b>	<b>10.1 Evaluation Criteria</b>	<b>10.2 Evaluation methods</b>	<b>10.3 Percentage of the final grade</b>
10.4 Course	Final evaluation	Written and oral exam	50%
10.5 Seminar	Involvement in activity throughout the semester	Questions / answers. Individual discussions	20%
10.6. Work for home	Correct resolution. Quality of presentation	Oral presentation. Individual discussions	30%
10.6 Minimum standard of performance	- Determining the type of load applied to a vehicle. - Determining the behavior of the tire under specific loads. - Evaluation of dynamic behavior of the vehicle.		

Date (of filling)  
19.09.2021

Instructor (lecture)  
Prof.PhD.Eng. **Ștefan TABACU**

Instructor (lab)  
Assoc prof.phd.eng. **Elena NEAGU**

Date (of approval)  
21.09.2021

Head of department (DAT)  
Lect.PhD.Eng. **Helene SUSTER**