COURSE SYLLABUS
Computer aided engineering for automotive applications
UP.02.DAP.3.O.21.22-AI

1. Program information

1.1	Higher education institution	The National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre
1.2	Faculty	Mechanics and Technology
1.3	Department	Automobiles and Transport
1.4	Field of studies	Automotive Engineering
1.5	Cycle of studies	Master
1.6	Program of study / Qualification	Automotive Engineering for Sustainable Mobility

2. Discipline information

2.1	Name of discipline	Computer aided engineering for automotive applications
2.2	Teacher of the project activities	Iorga-Simăn Victor

2.4	Year of the studies	II	2.5	Semester	I	2.6	Type of evaluation	C	2.7	The discipline regime	O

3. Estimated total time

3.1	Number of hours per week	2	3.2	from which project	2			
3.4	Total hours of the Academic Syllabus	28	3.5	from which project	28			

Distribution of the time allocated to the individual study	hours
Study by handbook, course support, bibliography and notes	30
Additional documentation in the library, on specialized electronic platforms and in the field	15
Preparation of seminars / laboratories, topics, reports, portfolios, essays	20
Tutorial	20
Examinations	4
Other activities	8

3.7	Total hours of individual study	97
3.8	**Total hours per semester[2]**	125
3.9	**Number of credits allocated to the discipline**	5

4. Preconditions (where applicable)

4.1	Curriculum	Not applicable
4.2	Skills	Fluid mechanics, Physics, Mathematics, Thermodynamics and Thermal Equipment, Internal Combustion Engines

5. Conditions (where applicable)

5.1	for the project	board, video projector, projection screen, computers, numerical simulation software

6. Specific skills accumulated

Professional skills	*C3. - calibration of different vehicle subsystems for energy optimization purposes* *C4. - experimental research with the purpose of validating the prototypes resulting from the activities of conception, design, modeling and numerical simulation* *C5. - documenting and exploiting the information* *C6 - professional communication*
transversal skills Transversale	*CT1. - Project Management* *CT2. - the responsible execution of professional tasks under conditions of autonomy* *CT3. - carrying out activities exploiting the ideas of teamwork and continuous improvement of one's own activity*

7. Objectives of the discipline

7.1 The main objective of the discipline	The general objective of the discipline is to learn how to use the CFD (Computational fluid dynamics) numerical simulation software in applications aimed at the automotive industry.
7.2 Specific goal(s)	- to know the of fluid mechanics used in Computational Fluid Dynamics. - to use the basic concepts about the discretization of the computational domain - to acquire the methodology of a CFD numerical approach: preprocessing, calculation, postprocessing for applications in the automotive industry (In-cilider flow, car aerodynamics, coolant circuit, intake manifold)

8. Contents

8.1. Project		No. hours	Teaching methods	Remarks Resources used
1	Fundamental concepts of fluid mechanics: velocity, pressure, viscosity, density, types of flow. Heat transfer: conduction, convection and radiation	2	*- Lecture* *- Exposure with support material*	*boardt, sketches, tables, graphs,*

2	Introduction in Computational Fluid Dynamics	2	- Explication - Description and exemplification	sheets, photos, models, video projector, computer, internet
3	Discretization of the calculation domain	2	- The heuristic conversation	
4	Intake manifold. AVL Fire	4	- Debate	
5	FAME_Hexa_Cooling_Jacket. AVL Fire	2	- State the problem	
6	Intake_Port. AVL Fire	4	-Exercise	
7	Car aerodynamics. AVL Fire	4		
8	In-cylinder engine. AVL Fire	8		
	TOTAL HOURS	**28**		

Minimal bibliography:

1. Iorga-Siman Victor, Clenci Adrian, Niculescu Rodica, Badea Ana, CFD study on the aerodynamic characteristics of the Aurel Persu's car, Revista Ingineria Automobilului (SIAR), Nr. 63, 3/2022, ISSN 1842 – 4074

2. Investigation of the Aerodynamic Performance of the Miller Cycle from Transparent Engine Experiments and CFD Simulations, Perceau, M ; Guibert, P ; Clenci, A ; Niculae, M ; Guilain, S ; Iorga-Siman, V
Machines, Volume 10, Issue 6, Article Number 467, DOI 10.3390/machines10060467, Published JUN 2022

3. Clenci, A ; Berquez, J ; Stoica, R ; Niculescu, R] ; Cioc, B ; Zaharia, ; Iorga-Siman, V, Experimental investigation of the effect of an afterburner on the light-off performance of an exhaust after-treatment system,
Energy reports ,Volume 8, Page 406-418, Supplement 9, DOI 10.1016/j.egyr.2022.07.025, Published NOV 2022

4. IORGA-SIMAN V., CLENCI, A., GUILAIN S. DANLOS, A., NICULESCU, R., TRICA, G. - „Unsteady in-cylinder flow in a four-valve spark ignition engine: numerical and experimental investigations" 15th European Automotive Congress, 3-5 October 2017, Madrid

5. CLENCI, A., NICULESCU, R., IORGA-SIMAN V, TRICĂ, A., DANLOS, A., - „On the Effect of Di-Ethyl-Ether (DEE) Injection upon the Cold Starting of a Biodiesel Fuelled Compression Ignition Engine", Technologies and Materials for Renewable Energy, Environment and Sustainability (TMREES), 16 - 18 November 2016, Paris, France

6. Niculae, M.; Clenci, A.; Iorga-Siman, V.; Niculescu, R. Évaluation de l'impact du masquage des soupapes d'admission et de l'augmentation de la course du piston sur l'aérodynamique interne du moteur Miller. Entropie Thermodyn. Énergie Environ. Économie **2021**

7. Penzel, M.; Bevilacqua, V.; Böger, M. Meeting Future Emission Standards with Turbocharged High-Performance Gasoline Engines. MTZ Worldw. **2020**, 81, 16–25. [CrossRef]

8. Scheidt, I.M.; Brands, I.C.; Kratzsch, M.; Günther, M. Combined Miller/Atkinson Strategy for Future Downsizing Concepts. MTZ Worldw. **2014**, 75, 4–11. [CrossRef]

9. Xu, J.; Guo, T.; Feng, Y.; Sun, M. Numerical investigation of Miller cycle with EIVC and LIVC on a high compression ratio gasoline engine. Sci. Prog. **2021**, 104, 368504211023640. [CrossRef] [PubMed]

10. Cao, Y. Sensibilité d'un Ecoulement de Rouleau Compressé et des Variations Cycle à Cycle Associées à des Paramètres de Remplissage Moteur. Ph.D. Thesis, ENSMA, Chasseneuil-du-Poitou, France, 2014.

11. El-Adawy, M.; Heikal, M.; Aziz, A.R.A.; Opatola, R.A. Stereoscopic particle image velocimetry for engine flow measurements: Principles and applications. Alex. Eng. J. **2021**, 60, 3327–3344.

12. Matsuda, M.; Yokomori, T.; Shimura, M.; Minamoto, Y.; Tanahashi, M.; Iida, N. Development of cycle-to-cycle variation of the tumble flow motion in a cylinder of a spark ignition internal combustion engine with Miller cycle. Int. J. Engine Res. **2020**, 22, 1512–1524.

13. Baum, E.; Peterson, B.; Surmann, C.; Michaelis, D.; Böhm, B.; Dreizler, A. Tomographic PIV measurements in an IC engine. In Proceedings of the 16th International Symposium on Applications of Laser Techniques to Fluid Mechanics

14. AVL Fire Exemples

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).

9. Evaluation

Activity type	10.1 Evaluation Criteria	10.2 Evaluation methods	10.3 Percentage of the final grade
10.4 Project	Presence at activity		10%
	Active involvement during the lectures	Weekly recording	20%
	Good understanding of the treated subjects and the ability to analyze and synthesize, final evaluation	Oral exam	30%
10.5 Homework	Correct resolution. Quality of presentation	Oral presentation. Individual discussions	40%
10.6 Minimum standard of performance	- minimum 50% activ participation in each periodic activity		

Date (of filling)
20.09.2023

Instructor (project)
lecturer phd **IORGA-SIMĂN Victor**

Date (of approval)
29.09.2023

Director of supplying department
..**Helene BĂDĂRĂU-ŞUSTER**

Director of beneficiary department
lecturer phd. **Helene BĂDĂRĂU-ŞUSTER**