



## SUBJECT DATA SHEET AND REQUIREMENTS

last modified: 7<sup>th</sup> January 2019

### AERODYNAMICS AND ITS APPLICATION FOR VEHICLES

### AERODINAMIKA ÉS ALKALMAZÁSA JÁRMŰVEKRE

1	Code	Semester Nr. or fall/spring	Contact hours/week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
	<b>BMEGEÁTMW19</b>	<b>4.(3.*)fall</b>	<b>1+0+1</b>	<b>p</b>	<b>3</b>	<b>English</b>

\*: in case of enrolment in fall

#### 2. Subject's responsible:

Name:	Title:	Affiliation (Department):
Dr. Jenő Miklós SUDA	assistant professor	Dept. of Fluid Mechanics

#### 3. Lecturer:

Name:	Title:	Affiliation (Department):
Dr. Jenő Miklós SUDA	assistant professor	Dept. of Fluid Mechanics
Dr. Balázs LENKEI	associate professor (invited lecturer)	Design Institute, MOME, Budapest

#### 4. Thematic background of the subject: Basics of Fluid Mechanics

#### 5. Compulsory / suggested prerequisites:

Compulsory: -

Suggested: Fluid Mechanics of BSc and /or MSc level.

#### 6. Main aims and objectives, learning outcomes of the subject:

To extend the knowledge of students in aerodynamics in general and in vehicle aerodynamics in particular as well as to contribute to development of skills of students in practical use of theoretical knowledge.

**7. Method of education:** lecture & laboratory measurement. Interactive lecture presentations and laboratory teamwork on wind tunnel testing of vehicle models.

#### 8. Detailed thematic description of the subject:

Introduction to Vehicle Aerodynamics

Summary of Aerodynamics (basics of fluid dynamics, bluff / streamlined body, boundary layers, aerodynamic forces and coefficients)

History of Vehicle Aerodynamics

Aerodynamics of passenger cars

Aerodynamics of racing / competition cars

Aerodynamics of heavy vehicles / buses and trucks

Wind tunnel testing and Computational Fluid Dynamics (CFD) simulation basics

Vehicle Design (invited lecture, Moholy-Nagy University of Arts and Design)

Wind tunnel lab session: projects for student groups. Model vehicle of approx. M 1:20 scale is to be created and tested in wind tunnel. Measurement of aerodynamic parameters (drag & lift), flow visualization study is to be performed. The measurements groups have to evaluate and compare to literature their measurement data, and present their measured & calculated data in an oral project presentation on the last lecture.



## 9. Requirements and grading

a) **in term-period** : The grading is based on 1 mid-term test (50% in final grade) and lab session (50% in final grade).

mid-term exam                    13<sup>rd</sup> week                    max.50points (min.40% =min.20points)    50% in final grade

lab session                        10<sup>th</sup>+13<sup>th</sup> weeks    max.50points (min.40% =min.20points)    50% in final grade

Totally max. 100 points equal to 100% as base of the final grading. Minimum 40 points (=40%) obtained out of the parts, for each item separately is obligatory.

Grading: 0%-39%: fail(1); 40%-54% pass(2), 55%-69%: satisfactory (3), 70%-84%: good(4), 85%-100%: excellent (5)

b) **in examination period**: -

c) **The students are subject to disciplinary measures against the application of unauthorized means at mid-terms, term-end exams and homework and the application of the 1/2013. (I.30.) Dean's Order must be followed.**

## 10. Retake and repeat

Retake of the mid-term test: on the 14<sup>th</sup> week, re-retake on the week for retakes. Neither repeated lab session wind tunnel measurements, nor repeated lab session presentation is offered. Absence from the labs and presentations is acceptable only with written medical document. Any further movements are due to the Code of Studies and Exams of BME.

## 11. Consulting opportunities:

Consultation hours: by email appointments and as it is indicated on the department's website.

## 12. Reference literature (compulsory & recommended):

- Aerodynamics of Road Vehicles (5<sup>th</sup> ed.), editor Thomas SCHUETZ, SAE International, 2016, ISBN 978-0-7680-7977-7
- Road Vehicle Aerodynamic Design – An introduction. (3<sup>rd</sup> ed.), R.H. Barnard, MechAero Publishing, 2009. ISBN 9 780954 073473
- Theory and Applications of Aerodynamics for Ground Vehicles (ed.), T. Yomi Obidi.: SAE International, 2014. ISBN 978-0-7680-2111-0
- Race Car Aerodynamics: Designing for Speed (ed.), J. Katz, Bentley Publishing, 2006. ISBN 978-0-8376-0142-7
- Competition Car Aerodynamics – A Practical Handbook (3<sup>rd</sup> ed.), Simon McBeath, Veloce Publishing Ltd, 2015, ISBN 978-1-845847-76-0
- The Aerodynamics of Heavy Vehicles III, Trucks, Buses and Trains, (Eds: Dillmann, Orellano), Series Title Lecture Notes in Applied and Computational Mechanics Series Vol.79. 2016 Publisher Springer International ISBN 978-3-319-20121-4
- Springer Handbook of Experimental Fluid Mechanics (Eds.: Tropea, Yarin, Foss), ISBN 978-3-540-25141-5 (Springer-Verlag Berlin 2007)
- Fundamentals of Aerodynamics by John D. Anderson (2<sup>nd</sup> ed.) McGraw-Hill International Edition 1991. ISBN 0-07-100767-9
- A History of Aerodynamics by John D. Anderson (1<sup>st</sup> ed.) Cambridge University Press 1999. ISBN 0-521-45435-2
- In Hungarian: Lajos T.: Az áramlástan alapjai (2015) Kiadja: Lajos Tamás, ISBN ISBN 978 963 12 2885 4.

Subject's website of lecture materials: [www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATMW19](http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATMW19)

## 13. Home study required to pass the subject:

Contact hours	28	h/semester
Home study for the courses	7	h/semester
Home study for the mid-semester checks	15	h/check
Preparation of mid-semester homework	28	h/homework
Home study of the allotted written notes	12	h/semester
Home study for the exam	-	h/semester
<b>Totally:</b>	<b>90</b>	<b>h/semester</b>

## 14. The data sheet and the requirements are prepared by:

Name:	Title:	Affiliation (Department):
Dr. Jenő Miklós SUDA	assistant professor	Dept. of Fluid Mechanics

