SUBJECT DATA SHEET AND REQUIREMENTS

last modified: 5th September 2016

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
BMEGEÁTMW19	4.(3.*)fall	1+0+1	p	3	English

*: 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
Prof. József SCHERER	professor (invited lecturer)	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 1h/w (1-7. weeks), seminar 0h/w, laboratory 1h/w (8-14. weeks). Interactive lecture presentations and laboratory teamwork on vehicle modelling and aerodynamic testing project.

8. Detailed thematic description of the subject:
1. Introduction to Vehicle Aerodynamics (bluff body / streamlined body aerodynamics)
2. Introduction to Aerodynamics (cont.),
   Basics of Car Design (invited lecturer from MOME)
3. Introduction to Aerodynamics (cont.),
4. History of Vehicle Aerodynamics
5. Aerodynamics of passenger cars
6. Aerodynamics of passenger cars (cont.)
7. Aerodynamics of passenger cars (cont.)
8. Aerodynamics of racing /competition cars
9. Aerodynamics of racing /competition cars (cont.)
10. Aerodynamics of heavy vehicles / buses and trucks
11. Aerodynamics of heavy vehicles / buses and trucks (cont.)
12. Introduction to wind tunnel testing and CFD simulation in vehicle aerodynamics
13. Summary, final conclusions on vehicle aerodynamic design studies

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Individual project: 2-4 students will form one lab group. Every group will receive a modelling package. With the help of wood, foam and plasticine etc. a model vehicle of approx. M 1:20 scale is to be created. The relative position of the pieces of woods can be freely chosen, as far as the model resembles a ground vehicle of your choice. The ground clearance (underbody gap) and the distance of the axes, the diameter/width of the wheels are prescribed (approx.). The maximum length of the model is 250mm, its minimum height is 60mm, and its width is between 82 and 90mm. Wind tunnel testing is to in the velocity range of 0-25 m/s, and at least 3 versions are to be created and tested: there is a wide range of possible attachments to apply on the base model /front & rear spoilers, wings, skirt, underbody cover, diffuser, ski boxes, etc./. In course of the 60 minutes wind tunnel testing the drag and lift force measurements flow visualization study must 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 (10min long) on the last class. The groups have to send their presentation by e-mail 2 working days before the presentation at the latest.

9. Requirements and grading

a) in term-period : The grading is based on 1 mid-term exam (50% in final grade) and individual project work (50% in final grade). The project work consists vehicle modelling (40% = 25% for aerodynamics and 15% for the design), and presentation of the vehicle modelling measurements and visualisation results (10% in final grade).

mid-term exam	11th week	max.50points (min.40% =min.20points)	50% in final grade
project: vehicle modelling	10th+13th weeks	max.40points (min.40% =min.16points)	40% in final grade
project: presentation & report	14th week	max.10points (min.40% =min.4points)	10% 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 exam: on the 13th week. Neither repeated laboratory measurement, nor repeated presentation is offered. Absence from the labs and presentation 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):

- W.-H. Hucho: Aerodynamics of Road Vehicles (5th ed.) SAE International 2016 ISBN of 978-0-7680-7977-7
- T. Yomi Obidi: Theory and Applications of Aerodynamics for Ground Vehicles. SAE International 2014. ISBN 978-0-7680-2111-0
- R.H. Barnard: Road Vehicle Aerodynamic Design – An introduction. (3rd ed) MechAero Publishing 2009. ISBN 9 780954 073473
- J. Katz: Race Car Aerodynamics: Designing for Speed. Bentley Publishing 2006. ISBN 978-0-8376-0142-7
- The Aerodynamics of Heavy Vehicles III, Trucks, Buses and Trains, Editor Andreas Dillmann, Alexander Orellano., Series Title Lecture Notes in Applied and Computational Mechanics Series Vol.79. 2016 Publisher Springer International ISBN 978-3-319-20121-4
- Julian Edgar: Amateur Car Aerodynamics Sourcebook. For everyone interested in road car aerodynamics. 2013, ISBN 1482735253
- Springer Handbook of Experimental Fluid Mechanics (Eds.: Tropea, Yarin, Foss), ISBN 978-3-540-25141-5 (Springer-Verlag Berlin 2007)
- Lajos T.: Az áramlástan alapjai (2015) Kiadja: Lajos Tamás, ISBN ISBN 978 963 12 2885 4.
- John D. Anderson: Fundamentals of Aerodynamics. (2nd ed.) McGraw-Hill International Edintion 1991. ISBN 0-07-100767-9

Downloadable lecture materials: 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
Totally:	90	h/semester

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

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