Budapest University of Technology and Economics
Faculty of Transportation Engineering and Vehicle Engineering

Autonomous Vehicle Control Engineering Master Programme

Major compulsory elective subjects
List and subject descriptions

Valid from September 2025

Major compulsory elective subjects

Subject name	Subject code	Language
Aircrafts	BMEKORHBsM8009-00	HU EN
Autonomous vehicle-based mobility services	BMEKOKKMsM8001-00	HU EN
Electromobility	BMEKOKKMsK2A02-00	HU EN
Machine vision	BMEKOALMsM8001-00	EN
Sustainable aviation	BMEKORHBsM8006-00	HU EN
Synergy of Engineering and Business: The Disruptive Transformation of the Truck Industry as a case study 1.	BMEKOKKBsM8001-00	EN
Synergy of Engineering and Business: The Disruptive Transformation of the Truck Industry as a case study 2.	BMEKOKKBsM8002-00	EN
System techniqe and analysis	BMEKOVJMsM8002-00	HU EN
Vehice operation, reliability, and diagnositcs	BMEKOVJMsM8001-00	HU EN

Subject description explanation

1. Subject name	official name of the subject
2. Subject name in Hungarian	official name of the subject in Hungarian
3. Programme	related programmes: k – transportation eng., j – vehicle engineering, l – logistics engineering, p – professional pilot
4. Subject code	Neptun code of the subject
5. Term / role	the term and the role (szk – major compulsory elective) of subject in the recommended curriculum
6. Credits	credit value of the subject
7. Evaluation type	type of academic performance assessment, e - exam grade; m - mid-term grade; s - signature
8. Nature	nature of teaching
9. Weekly contact hours	number of lessons for students by lecture, practice and lab
10. Language	language of teaching
11. SDG	learning outcomes' contribution to the EU/UN sustainable development goals
12. Working hours for fulfilling the requirements of the subject	contact hours – personal appearance at classes in a university preparation for seminars – preparation at home for the classes homework – preparation of homework and other assignments for the classes reading written materials – reviewing and understanding the taken lessons at home midterm preparation – recommended preparation time at home for the midterm test during the semester exam preparation – recommended preparation time at home for the exam
13. Organisational unit in charge	name of the organisational unit in charge of the subject
14. Subject coordinator and its position	name and position of the subject coordinator
15. Email address	email address of the subject coordinator
16. … organisational unit	name of the organisational unit for the subject coordinator
17. Instructors	name of the subject's instructor(s)
18. Indicative prerequisites	predefined criteria for registering the subject
19. Purpose	subject's role and purpose in the training programme
20. Programme of lectures	detailed content of the lecture course
21. Programme of practices	detailed content of the practice course
22. Programme of laboratories	detailed content of the laboratory course
23. Learning outcomes	results to achieve at the end of the learning process, grouped by competences (lower case), furthermore their link to the training programme's learning outcomes (upper case)
24. Midterm assessments	name and code of assessments in the study period, their share in the final grade, and the evaluated learning outcomes
25. Exams	a name and code of assessments in the exam period, their share in the final grade, and the evaluated learning outcomes
26. Criteria to obtain a signature / midterm grade	criteria that shall be met to obtain the signature / midterm grade from the subject
27. Grading rules	rules of grading in share (%) of the summarised results of assessments
28. Attendance and participation requirements	derogations from the main rule laid down by the Code of Studies
29. Retake and delayed completion	requirements for passing the subject, aspects of performance evaluation, way to determine a grade (obtain a signature)
30. Consultation	consultation oppportunities offered by the instructor(s)
31. Learning materials	notes, textbooks, suggested literature, recommended learning support materials in printed or electronic form
32. Start of validity for the subject decription	start of vailidy for the information laid down by the subject decription

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
Faculty of Transportation Engineering and Vehicle Engineering

Subject description

1. Subject name	**Aircrafts**				
2. Subject name in Hungarian	Légijárművek			**3. Programme**	AJkl
4. Subject code	**BMEKORHBsM8009-00**			**5. Term | role**	**- | szk**
6. Credits	**3**	**7. Evaluation type**	**m**	**8. Nature**	**contact lessons**
9. Weekly contact hours	**2 lecture**	**0 practice**	**0 laboratory**	**10. Language**	**HU EN**
11. SDG Learning outcomes' contribution to the EU/UN sustainable development goals					
12. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for lessons**	20 hours	**Homework**	0 hours
Reading written materials	22 hours	**Midterm preparation**	20 hours	**Exam preparation**	0 hours

13. Organisational unit in charge	Department of Aeronautics and Naval Architecture		
14. Subject coordinator and its position	Dr. Rohács Dániel associate professor	**15. Email address**	rohacs.daniel@kjk.bme.hu
16. …organisational unit	Department of Aeronautics and Naval Architecture		
17. Instructor(s)	Gál István		

18. Indicative prerequisites	- - -, - - -, - - -

19. Purpose

The student will acquire knowledge of the basic elements, systems and solutions of aircraft and aviation.

20. Programme of lectures

History, types and operation of aircraft (civil and military), trends in development
Flight fundamentals (aerodynamics and flight mechanics)
Aircraft structure and systems
Propulsion and engines
Safety, environmental and aviation regulations
Aircraft production, operation, maintenance and repair
Air transport
Air traffic control
Airports and air traffic services

21. Programme of practices

-

22. Programme of laboratories

-

23. Learning outcomes (lower case) and their link to the traning programme's learning outcomes (upper case)

The student
a) knowledge (t)
1. knows the purposes for which aircraft are used, the types of aircraft, their operation and their expected evolution
2. knows the processes, infrastructure, tools, equipment and activities related to the operation and management of aircraft
b) skills (k)
1. is able to formulate a professional opinion on the most relevant aspects of aircraft operations on the basis of the knowledge acquired
c) attitude (a)
1. has vision, systems thinking, teamwork, planning, prioritising and documenting tasks accurately
2. complies with the safety rules and regulations to which he/she is familiar
3. respects sustainability and the environment
d) autonomy and responsibility (o)
1. can represent safety, technical and sustainability aspects in decision-making situations

24. Midterm assessments

Name	Code	Share in final grade	Evaluated learning outcomes
1. midterm exam that can be substituted by a submitted individual assignment.	1. ZH or optionally BF	1. 100%	1. t1-2,k1,a1-3,o1

25. Exams

Name	Code	Share in final grade	Evaluated learning outcomes

26. Criteria to obtain a signature / midterm grade

pass the final examination with at least 50% of the mark or acceptance of the assignment to be submitted

27. Grading rules

Excellent 80-100%
Good 70-79%
Satisfactory 60-69%
Pass 50-59%
Fail 0-49%

28. Attendance and participation requirements

According to the rules of Study and Examination Regulations.

29. Retake and delayed completion

Late completion of summative assessments is allowed for a second time in the late completion period upon payment of a special charge.

30. Consultation

at a time and in a form agreed with the lecturers

31. Learning materials

Lecture notes by the Department

32. Start of validity for the subject decription

September 1st, 2025

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
Faculty of Transportation Engineering and Vehicle Engineering

Subject description

1. Subject name	**Autonomous vehicle-based mobility services**				
2. Subject name in Hungarian	Autonóm járművekre épülő mobilitási szolgáltatások			**3. Programme**	AJ
4. Subject code	**BMEKOKKMsM8001-00**			**5. Term | role**	**- | szk**
6. Credits	**3**	**7. Evaluation type**	**m**	**8. Nature**	**contact lessons**
9. Weekly contact hours	**1 lecture**	**1 practice**	**0 laboratory**	**10. Language**	**HU EN**
11. SDG Learning outcomes' contribution to the EU/UN sustainable development goals					
12. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for lessons**	5 hours	**Homework**	27 hours
Reading written materials	10 hours	**Midterm preparation**	20 hours	**Exam preparation**	0 hours

13. Organisational unit in charge	Department of Transport Technology and Economics		
14. Subject coordinator and its position	Dr. Földes Dávid research fellow	**15. Email address**	foldes.david@kjk.bme.hu
16. …organisational unit	Department of Transport Technology and Economics		
17. Instructor(s)	Dr. Földes Dávid, Dr. Csiszár Csaba, Dr. Csonka Bálint		

18. Indicative prerequisites	- - -, - - -, - - -

19. Purpose

Understanding mainly road-based mobility services built on autonomous vehicles, and the specific aspects of their planning and operation. Familiarization with the acceptance barriers of autonomous vehicles and an overview of their expected transport and societal impacts. Acquiring transportation engineering principles and best practices for planning autonomous road vehicle-based demand-responsive mobility services.

20. Programme of lectures

Current transport system and modes (shared mobility services), general issues of transport sectors (traffic size, pollution, safety), supply and demand alignment, the role of the human factor. Alteration in transport modes after introduction of autonomous vehicles, service types, and future of mobility scenarios. Literature review on autonomous vehicle-based mobility services; evolution of publications in the field (topics, keywords). Automated vehicles in railway and aviation. Planning of autonomous vehicle-based mobility services. Operation of autonomous vehicle-based mobility services. Impact of autonomous vehicles (safety, traffic, environmental, land use, economic). Social acceptance of autonomous vehicles (expectations, trust, data protection, ethics). Case studies: autonomous vehicle-based mobility services.

21. Programme of practices

Case studies: autonomous vehicle-based mobility services. Fundamentals and calculations for planning demand-responsive mobility services (e.g., determination of pick-up points, capacity planning, service cost and quality). Design principles specific to autonomous vehicles. Development and presenatation of semester assignment.

22. Programme of laboratories

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23. Learning outcomes (lower case) and their link to the traning programme's learning outcomes (upper case)

The student

a) knowledge (t)

1. Understands autonomous vehicle-based mobility services.
2. Understands the planning and operational characteristics specific to autonomous vehicle-based mobility services.
3. Becomes familiar with the expected impacts of autonomous vehicles.

b) skills (k)

1. Applies transport planning aspects in addition to vehicle or control software design.
2. Designs and visualizes autonomous vehicle-based mobility services at a conceptual level.
3. Considers the social, transport-related, and economic impacts of autonomous vehicles.

c) attitude (a)

1. Recognizes that a system-oriented approach is required for the introduction of autonomous vehicles.
2. Strives to enhance the social acceptance of autonomous vehicles.

3. Aims to carry out work with a system- and process-oriented mindset, applying a complex approach that incorporates sustainability and economic considerations.

4. Strives for comprehensiveness in acquiring knowledge and collaborates with the teacher.

d) autonomy and responsibility (o)

1. Makes responsible decisions in evaluating, planning, and operating autonomous vehicle-based mobility services.

2. Formulates independent proposals for economically, socially, and environmentally efficient autonomous vehicle-based mobility services.

24. Midterm assessments

Name	Code	Share in final grade	Evaluated learning outcomes
1. midterm test 2. semester assignment (Conceptual design of an autonomous vehicle-based demand-responsive service)	1. ZH 2. F	1. 70% 2. 30%	1. t1-3,k3,a4 2. k1-2,a1-4,o1-2

25. Exams

Name	Code	Share in final grade	Evaluated learning outcomes

26. Criteria to obtain a signature / midterm grade

Successful (min. 50%) completion of the midterm test and submission and acceptance of the semester assignment.

27. Grading rules

Excellent 85-100%
Good 75-84.5%
Satisfactory 60-74.5%
Pass 50-59.5%
Fail 0-49%

28. Attendance and participation requirements

according to the rules of CoS

29. Retake and delayed completion

The midterm test can be retaken during the semester on the date announced at the beginning of the semester. The semester assignment may be submitted after the original deadline until Wednesday of the make-up week, subject to an additional administrative fee. During the make-up week, only one of the midterm assessments may be retaken.

30. Consultation

At a time and in a form agreed with the teacher

31. Learning materials

Presentation slides, thematic scientific papers

32. Start of validity for the subject decription

September 1st, 2025

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
Faculty of Transportation Engineering and Vehicle Engineering

Subject description

1. Subject name	**Electromobility**				
2. Subject name in Hungarian	Elektromobilitás			**3. Programme**	AJL
4. Subject code	**BMEKOKKMsK2A02-00**			**5. Term | role**	**- | szk**
6. Credits	**3**	**7. Evaluation type**	**m**	**8. Nature**	**contact lessons**
9. Weekly contact hours	**1 lecture**	**1 practice**	**0 laboratory**	**10. Language**	**HU EN**
11. SDG Learning outcomes' contribution to the EU/UN sustainable development goals					
12. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for lessons**	6 hours	**Homework**	35 hours
Reading written materials	6 hours	**Midterm preparation**	15 hours	**Exam preparation**	0 hours

13. Organisational unit in charge	Department of Transport Technology and Economics		
14. Subject coordinator and its position	Dr. Csonka Bálint senior research fellow	**15. Email address**	csonka.balint@kjk.bme.hu
16. …organisational unit	Department of Transport Technology and Economics		
17. Instructor(s)	Dr. Csonka Bálint, Dr. Földes Dávid		

18. Indicative prerequisites	- - -, - - -, - - -

19. Purpose

Understanding the components, characteristics, functioning, relationships, trends and challenges of the electromobility system. Learn analytical and design methods, procedures and applications for the planning and operation of electromobility services through best practices and the semester-long design assignment.

20. Programme of lectures

Electromobility system; Electrification of urban bus networks; Vehicle and battery technology; Charging infrastructure and charging management; Economic and environmental impacts; Hydrogen-based electromobility.

21. Programme of practices

As part of the practice, students will be given a semester-long design assignment to solve individually or in groups. The results must be presented in 10-15 minutes by the students. The practice and the assignment are based on the following topics: Cluster analysis of bus routes based on operational characteristics; Linear programming in Matlab: objective functions, criteria, algorithms; Energy modelling of bus terminals and design of charging infrastructure; Modelling of bus network and design of trolleybus network; Optimisation of bus services: turn planning, charging management.

22. Programme of laboratories

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23. Learning outcomes (lower case) and their link to the traning programme's learning outcomes (upper case)

The student

a) knowledge (t)

1. Knows and understands the specific methods, technologies, and applications of electromobility systems and solutions for the integration into the transport system
2. Knows the tools and methods related to linear programming modelling for electric bus services and charging management
3. Knows and understands the methodology and tools for the design and research of electromobility services

b) skills (k)

1. Able to process and organise information collected on electromobility, analyse it, draw conclusions and explore the connections and further develop services
2. Able to solve problems creatively and solve complex problems flexibly in the field of electromobility, based on a systems and process-oriented way of thinking
3. Able to assess the status of electromobility services, to develop an evaluation and a proposal, to develop, plan, organise and manage complex service systems at a high level

c) attitude (a)

1. Open and receptive to technological development and innovation in electromobility, and a credible presenter in the topic.
2. Strives to contribute to the development of new methods related to electromobility.

3. Strives to carry out his/her work based on a systems and process-oriented mindset, in a complex approach, taking into account sustainability and economic aspects.

4. 1. strives for completeness in the acquisition of knowledge, cooperates with the teacher and fellow students, is empathetic and tolerant towards members of his/her team.

d) autonomy and responsibility (o)

1. In addition to narrow professional criteria, ensures sustainability in the use of his/her knowledge, is able to self-monitor and correct errors independently, while taking into account the professional opinion of others

2. Makes responsible decisions in analysis, planning and operation of electromobility services, and formulates independent proposals to solve identified challenges

24. Midterm assessments

Name	Code	Share in final grade	Evaluated learning outcomes
1. midterm test 2. urban bus service electrification assignment	1. ZH 2. HF	1. 50% 2. 50%	1. t1,t2,t3,k1,k3,a1,a3,a4,o1,o2, 2. t1,t2,t3,k1,k2,k3,a1,a2,a3,a4,o2

25. Exams

Name	Code	Share in final grade	Evaluated learning outcomes

26. Criteria to obtain a signature / midterm grade

submission and presentation of task on time and successful (min. 50%) completion of the midterm test

27. Grading rules

Excellent 88-100%
Good 75-87%
Satisfactory 63-74%
Pass 50-62%
Fail 0-49%

28. Attendance and participation requirements

according to the rules of CoS

29. Retake and delayed completion

second retake or delayed completion is only from one midterm requirement

30. Consultation

at a time and in a form agreed with the teacher

31. Learning materials

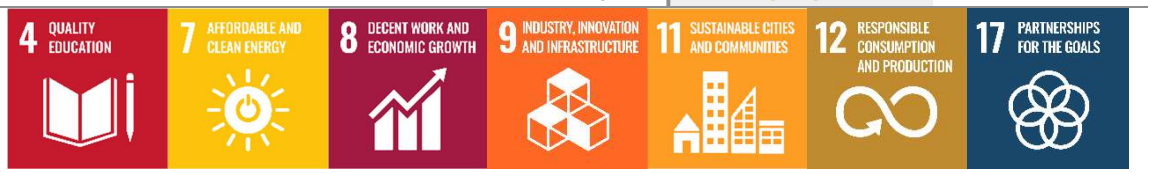
presentation slides

32. Start of validity for the subject decription

September 1st, 2025

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
Faculty of Transportation Engineering and Vehicle Engineering

Subject description

1. Subject name	**Machine vision**				
2. Subject name in Hungarian	Gépi látás			**3. Programme**	A
4. Subject code	**BMEKOALMsM8001-00**			**5. Term | role**	**- | szk**
6. Credits	**3**	**7. Evaluation type**	**m**	**8. Nature**	**contact lessons**
9. Weekly contact hours	**1 lecture**	**1 practice**	**0 laboratory**	**10. Language**	**EN**
11. SDG Learning outcomes' contribution to the EU/UN sustainable development goals					
12. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for lessons**	12 hours	**Homework**	20 hours
Reading written materials	10 hours	**Midterm preparation**	20 hours	**Exam preparation**	0 hours

13. Organisational unit in charge	Department of Material Handling and Logistics Systems		
14. Subject coordinator and its position	Dr. Rózsa Zoltán research fellow	**15. Email address**	rozsa.zoltan@kjk.bme.hu
16. …organisational unit	Department of Material Handling and Logistics Systems		
17. Instructor(s)	Dr. Szirányi Tamás, Dr. Rózsa Zoltán		

18. Indicative prerequisites	- - -, - - -, - - -

19. Purpose

The course aims to provide students with an understanding of the principles and applications of 3D machine vision. To this end, they will acquire theoretical knowledge ranging from calibration to biometrics to 3D reconstruction and LiDAR technology. Through laboratory exercises, they will learn the practical implementation of these concepts, with a particular focus on point cloud processing and SLAM techniques.

20. Programme of lectures

During the lectures, students will learn the basics of video motion analysis, the operation of biometric systems, and the MRF and fMRF models used for spatial inference. The basics of 3D vision, stereo imaging, and LiDAR technology will be presented in detail, complemented by the importance of sensor calibration. Finally, the course will touch on VO-SLAM methods essential for spatial orientation and mapping of robots.

21. Programme of practices

Computer exercises; MATLAB programming

22. Programme of laboratories

-

23. Learning outcomes (lower case) and their link to the traning programme's learning outcomes (upper case)

The student

a) knowledge (t)

1. knows three-dimensional shape recognition methods,

2. is familiar with environmental reconstruction technologies3. is familiar with modern, neural network-based approaches to 3D machine vision

b) skills (k)

1. designs 3D object and shape recognition algorithm,

2. can see the architectural issues of a machine vision system,

3. is able to select a suitable tool and algorithm for a given task.

c) attitude (a)

1. open to learn about modern 3D vision systems

2. open to automatic use of machine vision in vehicle control

d) autonomy and responsibility (o)

1. can participate in image processing projects independently or in a team,

2. responsibly designs a vision system that meets the given task and safety requirements

24. Midterm assessments

Name	Code	Share in final grade	Evaluated learning outcomes
1. midterm test 2. homework	1. ZH 2. HF	1. 60 % 2. 40 %	1. t1-t3,k1-k3,a1,a2,o1,o2 2. t1-t3,k1-k3,a1,a2,o1,o2

25. Exams

Name	Code	Share in final grade	Evaluated learning outcomes

26. Criteria to obtain a signature / midterm grade

At least 50% completion of the midterm and homework assignment separately.

27. Grading rules

Excellent 80-100%
Good 70-79%
Satisfactory 60-69%
Pass 50-59%
Fail 0-49%

28. Attendance and participation requirements

According to the rules of CoS.

29. Retake and delayed completion

According to the rules of CoS.

30. Consultation

At a time and in a form agreed with the teacher.

31. Learning materials

Students can download the electronic learning materials and other aids related to the subject from the e-learning framework used.

32. Start of validity for the subject decription

September 1st, 2025

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
Faculty of Transportation Engineering and Vehicle Engineering

Subject description

1. Subject name	**Sustainable aviation**				
2. Subject name in Hungarian	Fenntartható repülés			**3. Programme**	Ajl
4. Subject code	**BMEKORHBsM8006-00**			**5. Term | role**	**- | szk**
6. Credits	**3**	**7. Evaluation type**	**m**	**8. Nature**	**contact lessons**
9. Weekly contact hours	**2 lecture**	**0 practice**	**0 laboratory**	**10. Language**	**HU EN**
11. SDG Learning outcomes' contribution to the EU/UN sustainable development goals					
12. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for lessons**	22 hours	**Homework**	29 hours
Reading written materials	11 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

13. Organisational unit in charge	Department of Aeronautics and Naval Architecture		
14. Subject coordinator and its position	Dr. Rohács Dániel associate professor	**15. Email address**	rohacs.daniel@kjk.bme.hu
16. …organisational unit	Department of Aeronautics and Naval Architecture		
17. Instructor(s)	Gál István		
18. Indicative prerequisites	- - -, - - -, - - -		

19. Purpose

Understanding the fundamental aspects of sustainable and green aviation, reviewing the basic regulatory environment, environmental impacts, potential technological solutions, alternative propulsion systems, procedures, and related airport and ATM area concepts.

20. Programme of lectures

Week 1: Introduction to sustainable aviation
- Definition and importance of sustainability in aviation
- Environmental impacts of aviation (carbon dioxide emissions, noise pollution, etc.)

Week 2: Regulatory frameworks
- Regulatory and measurement bases, rules and regulations determining sustainability and environmental protection

Week 3-4: Basic environmental impacts
- The contribution of aviation to global CO_2 emissions
- The formation of greenhouse gases and contrails
- Definition and measurement of pollutant emissions
- Other environmental impacts

Weeks 5-6: Aviation Noise
- Basic Noise Sources
- Noise Measurement Methods
- Noise Reduction Methodologies

Week 7: Sustainable Propulsion Systems
- Types of SAF (Biofuels, Synthetic Fuels, Hydrogen)
- Fundamentals of Hydrogen and Electric Propulsion
- Battery-Electric Aircraft and Hybrid-Electric Propulsion
- Case Studies on SAF Implementation (Airlines and Manufacturers)

Week 8-9 Week 1: Airport and airline sustainability strategies and operational measures
- Green airport initiatives (energy-efficient infrastructure, sustainable operations)
- Carbon offset programs and net zero targets
- Case studies on sustainable airlines and airports

Week 10: Urban air mobility (UAM) and sustainable aviation
- eVTOLs and electric air taxis
- Integrating UAM into existing airspace
- Sustainable benefits and challenges of UAM

Week 11: Future trends
- New technologies and R&D in sustainable aviation
Weeks 12-14: Student case studies
- Student presentations on sustainability case studies

21. Programme of practices

-

22. Programme of laboratories

-

23. Learning outcomes (lower case) and their link to the traning programme's learning outcomes (upper case)

The student

a) knowledge (t)

1. knows the topics of the subject. The student knows the relevant literature and knows where to find more detailed information for each field of study to complete his/her task.

b) skills (k)

1. is able to independently prepare documentation related to the areas covered by the subject matter
2. is able to recognize the changes that are relevant to the topics and are necessary in order to achieve the expected goal.
3. is able to think, plan, control, evaluate and make decisions in complex systems and processes, and to carefully consider the effects on the case under study and the impact of his/her activities on other systems.

c) attitude (a)

1. strives to complete his studies at the highest possible level, in the shortest possible time, by providing the maximum of his knowledge and abilities, acquiring in-depth knowledge capable of independent creation.
2. cooperates with the instructor and fellow students in expanding his knowledge.
3. expands his knowledge through continuous independent acquisition of knowledge, supplementing what has been taught in the course.

d) autonomy and responsibility (o)

1. completes the assignments independently.
2. feels responsible for setting an example to the peers with the quality of the work and adherence to ethical standards.
3. applies the knowledge acquired during the course responsibly, taking into account the limitations of its validity.
4. is open to well-founded critical comments and uses them constructively in the future.
5. accepts the framework of cooperation and is able to perform his/her work independently or as part of a team, depending on the situation.

24. Midterm assessments

Name	Code	Share in final grade	Evaluated learning outcomes
1. homework	1. HF	1. 100%	1. t1,k1-3,a1-3,o1-5

25. Exams

Name	Code	Share in final grade	Evaluated learning outcomes

26. Criteria to obtain a signature / midterm grade

submission and presentation of task on time

27. Grading rules

Excellent 88-100%
Good 75-87%
Satisfactory 63-74%
Pass 50-62%
Fail 0-49%

28. Attendance and participation requirements

according to the rules of CoS

29. Retake and delayed completion

Late completion of summative assessments is allowed for a second time in the late completion period upon payment of a special charge.

30. Consultation

at a time and in a form agreed with the teacher

31. Learning materials

Lecture notes, materials and documentations in printed and/or electronic version given by the lecturer.

32. Start of validity for the subject decription

September 1st, 2025

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
Faculty of Transportation Engineering and Vehicle Engineering

Subject description

1. Subject name	**Synergy of Engineering and Business: The Disruptive Transformation of the Truck Industry as a case study 1.**				
2. Subject name in Hungarian	Synergy of Engineering and Business: The Disruptive Transformation of the Truck Industry as a case study 1.			**3. Programme**	AI
4. Subject code	**BMEKOKKBsM8001-00**			**5. Term | role**	**- | szk**
6. Credits	**3**	**7. Evaluation type**	**m**	**8. Nature**	**contact lessons**
9. Weekly contact hours	**1 lecture**	**1 practice**	**0 laboratory**	**10. Language**	**EN**
11. SDG Learning outcomes' contribution to the EU/UN sustainable development goals					
12. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for lessons**	20 hours	**Homework**	27 hours
Reading written materials	15 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

13. Organisational unit in charge	Department of Transport Technology and Economics		
14. Subject coordinator and its position	Dr. Mészáros Ferenc associate professor	**15. Email address**	meszaros.ferenc@kjk.bme.hu
16. …organisational unit	Department of Transport Technology and Economics		
17. Instructor(s)	Dr. Jürgen Steinberger		
18. Indicative prerequisites	- - -, - - -, - - -		

19. Purpose

Technological developments in the truck industry have accelerated significantly in recent years, with a particular focus on automation and connected vehicle systems. Today, the automotive industry requires not only precise engineering knowledge, but also complex organisational, business and management skills with a market perspective. This course covers the legislative, business, and market factors.

20. Programme of lectures

The truck industry has been the steady, slow changing backbone of the logistic industry for decades. 70% of the goods shipped on land are transported by trucks. Technologies, market players and business models has changed and developed slowly, gradually, and evolutionary. With 20 times the weight and 5 times the lifetime of a passenger car, the requirements for the reliability and safety of a truck have defined industry standards, worldwide.

However, over the last 5 years the speed of change with respect to legal requirements, market consolidation, business models and technology changes has factually exploded. Emerging countries like India, Brazil and China have defined a sequence of legislative rules for new safety standards requiring ESP and new ADAS (Advanced Driver Assistance Systems). European legislation is focusing on emission reduction, functional safety requirements as well as cyber security standards. A former fragmented market with numerous small regional truck manufacturer is consolidating to a few global and regional players, driving purchasing power and technical standardization. At the same time, driver shortage and continuously increasing costs for trucks and infrastructure demand automated solutions. In consequence, new safety standards, Connectivity and Highly Automated Driving solutions as well as E-Mobility and emission reduction systems are going to be developed within the next 5 to 7 years, each region setting a different focus and timeline.

The challenges could not be greater. Due to the possibility of setting technical and business standards, time to market becomes crucial. Concurrently, the focus on talents has shifted from the classical mechanical expertise towards electrical, software and system engineering. To manage the challenges, new organizational and management approaches need to be implemented.

The highlighted topics to be discussed are the business, ecological and social factors, the legal framework conditions, as well as technical management, structural and organizational change needs. The lectures of the semester are organized into 4 blocks, each of which is 3 x 1:30 long, with 2 x 10-minute breaks between them. Another 2 x 1:30 sessions are reserved for the exam and one retake option.

21. Programme of practices

2x case studies to be elaborated as a teamwork:

(1) Analyse the disruption of HAD and E-mobilty for a European and a Chinese Truck manufacturer, define the counterstrategy and draw a worldwide picture of the truck industry in 10 years

(2) Feasibiliy Study and Business Case Analysis for a new business field in E-mobilty: Thermal Battery Management for Tier 1

22. Programme of laboratories

-

23. Learning outcomes (lower case) and their link to the traning programme's learning outcomes (upper case)

The student

a) knowledge (t)

1. focuses on and explain the technology changes and challenges in detail, while giving the students the necessary background information to understand the legal, business and market drivers.

b) skills (k)

1. to complete the picture, gets acquainted with new organizational and technical management approaches to face the upcoming challenges.

c) attitude (a)

1. in addition to the technical competence, is able to understand and analyze problems based on business, market, and legal aspects, as they actually appear in real life.

d) autonomy and responsibility (o)

1. can make responsible decisions independently and prepare decision-making materials considering technical, business, market and legal aspects.

24. Midterm assessments

Name	Code	Share in final grade	Evaluated learning outcomes
1. Case study report (team work) 2. Case study report (team work)	1. CSR1 2. CSR2	1. 50% 2. 50%	1. t1,k1,a1,o1 2. t1,k1,a1,o1

25. Exams

Name	Code	Share in final grade	Evaluated learning outcomes

26. Criteria to obtain a signature / midterm grade

The midterm grade is primarily based on the student's activity and the submitted case study. Grading: Students must form teams of 5. Each team receives a maximum of 5 points per person to distribute among its members: 1-5 per person. The group members dec

27. Grading rules

Excellent 81-100%
Good 61-80%
Satisfactory 41-60%
Pass 40%
Fail 0-39%

28. Attendance and participation requirements

according to the rules of CoS

29. Retake and delayed completion

The case study work can be retaken once.

30. Consultation

at a time and in a form agreed with the teacher

31. Learning materials

Lecture notes

32. Start of validity for the subject decription

September 1st, 2025

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
Faculty of Transportation Engineering and Vehicle Engineering

Subject description

1. Subject name	**Synergy of Engineering and Business: The Disruptive Transformation of the Truck Industry as a case study 2.**				
2. Subject name in Hungarian	Synergy of Engineering and Business: The Disruptive Transformation of the Truck Industry as a case study 2.			**3. Programme**	AI
4. Subject code	**BMEKOKKBsM8002-00**			**5. Term | role**	**- | szk**
6. Credits	**3**	**7. Evaluation type**	**m**	**8. Nature**	**contact lessons**
9. Weekly contact hours	**1 lecture**	**1 practice**	**0 laboratory**	**10. Language**	**EN**
11. SDG Learning outcomes' contribution to the EU/UN sustainable development goals					
12. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for lessons**	20 hours	**Homework**	27 hours
Reading written materials	15 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

13. Organisational unit in charge	Department of Transport Technology and Economics		
14. Subject coordinator and its position	Dr. Mészáros Ferenc associate professor	**15. Email address**	meszaros.ferenc@kjk.bme.hu
16. …organisational unit	Department of Transport Technology and Economics		
17. Instructor(s)	Dr. Jürgen Steinberger		
18. Indicative prerequisites	- - -, - - -, - - -		

19. Purpose

Technological developments in the truck industry have accelerated significantly in recent years, with a particular focus on automation and connected vehicle systems. Today, the automotive industry requires not only precise engineering knowledge, but also complex organisational, business and management skills with a market perspective. This course covers the technological changes and challenges.

20. Programme of lectures

The truck industry has been the steady, slow changing backbone of the logistic industry for decades. 70% of the goods shipped on land are transported by trucks. However, over the last 5 years the speed of change with respect to legal requirements, market consolidation, business models and technology changes has factually exploded. The subject reviews – based on the legislative, business and market factors – the technical changes and challenges.

Main chapters of the lecture are:

- Worldwide standardization of active safety systems (braking-, steering- and ADAS systems).
- Business rational of ADAS systems, technical approach and industrial approach and strategic considerations consequently.
- Connectivity: areas and market model, interaction with HAD, ADAS and Chassis Control Systems.
- E-mobility: Market drivers and regional penetration scenarios, technology changes and consequences on the truck.
- Functional Safety: redundancy and diagnostic requirements for different ASIL levels, technical concepts / implementation examples: sensor / actuator checking; plausibility checks; cost-optimized redundancy solutions
- Cybersecurity: market needs and consequences, technical concepts.

The lectures of the semester are organized into 4 blocks, each of which is 3 x 1:30 long, with 2 x 10-minute breaks between them.

21. Programme of practices

2x case studies to be elaborated as a teamwork.

22. Programme of laboratories

-

23. Learning outcomes (lower case) and their link to the traning programme's learning outcomes (upper case)

The student

a) knowledge (t)

1. focuses on and explain the technology changes and challenges in detail, while giving the students the necessary background information to understand the legal, business and market drivers.

b) skills (k)

1. to complete the picture, gets acquainted with new organizational and technical management approaches to face the upcoming challenges.

c) attitude (a)

1. in addition to the technical competence, is able to understand and analyze problems based on business, market, and legal aspects, as they actually appear in real life.

d) autonomy and responsibility (o)

1. can make responsible decisions independently and prepare decision-making materials considering technical, business, market and legal aspects.

24. Midterm assessments

Name	Code	Share in final grade	Evaluated learning outcomes
1. Case study report (team work) 2. Case study report (team work)	1. CSR1 2. CSR2	1. 50% 2. 50%	1. t1,k1,a1,o1 2. t1,k1,a1,o1

25. Exams

Name	Code	Share in final grade	Evaluated learning outcomes

26. Criteria to obtain a signature / midterm grade

The midterm grade is primarily based on the student's activity and the submitted case study. Grading: Students must form teams of 5. Each team receives a maximum of 5 points per person to distribute among its members: 1-5 per person. The group members dec

27. Grading rules

Excellent 81-100%
Good 61-80%
Satisfactory 41-60%
Pass 40%
Fail 0-39%

28. Attendance and participation requirements

according to the rules of CoS

29. Retake and delayed completion

The case study work can be retaken once.

30. Consultation

at a time and in a form agreed with the teacher

31. Learning materials

Lecture notes

32. Start of validity for the subject decription

September 1st, 2025

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
Faculty of Transportation Engineering and Vehicle Engineering

Subject description

1. Subject name	**System techniqe and analysis**				
2. Subject name in Hungarian	Rendszertechnika és rendszeranalízis			**3. Programme**	AJKL
4. Subject code	**BMEKOVJMsM8002-00**			**5. Term | role**	**- | szk**
6. Credits	**3**	**7. Evaluation type**	**m**	**8. Nature**	**contact lessons**
9. Weekly contact hours	**1 lecture**	**1 practice**	**0 laboratory**	**10. Language**	**HU EN**
11. SDG Learning outcomes' contribution to the EU/UN sustainable development goals					
12. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for lessons**	12 hours	**Homework**	0 hours
Reading written materials	22 hours	**Midterm preparation**	28 hours	**Exam preparation**	0 hours

13. Organisational unit in charge	Department of Railway Vehicles and Vehicle System Analysis		
14. Subject coordinator and its position	Dr. Zábori Zoltán senior research fellow	**15. Email address**	zabori.zoltan@kjk.bme.hu
16. …organisational unit	Department of Railway Vehicles and Vehicle System Analysis		
17. Instructor(s)	Dr. Zábori Zoltán		
18. Indicative prerequisites	- - -, - - -, - - -		

19. Purpose

Learning the basic methods of vehicle and machine structure analysis, developing a systems approach

20. Programme of lectures

Systems-based vehicle and machine analysis. System characterisation using graph theory. Structural structure-hierarchy, element, element group, machine and machine system. Effect diagram, structure graph and signal flow diagram of complex systems. Ways of describing system relationships. Transfer properties, operators. Linear and nonlinear systems. Construction of action diagram of vehicle systems and analysis of system output. System equation generation by synthetic and analytical methods. Lagrange and Hamiltonian equations. General theory of linear systems. Investigation in the time domain and frequency domain for periodic, aperiodic and weakly stationary stochastic spreading, SIMO and MIMO systems. Analysis of coherence relations.

21. Programme of practices

Exercising of the theoretical material by the solving of the numerical examples.

22. Programme of laboratories

-

23. Learning outcomes (lower case) and their link to the traning programme's learning outcomes (upper case)

The student

a) knowledge (t)

1. Understands and applies the mathematical and scientific principles and procedures of system technique and system analysis.
2. Understands and can apply in a wide circle the theories and terminologies elaborated for professional area of system technique and system analysis.
3. Knows and understands the basic facts, limits and development possibilities of system technique and system analysis.
4. Knows and is capable to understand in details the methods of modelling in system technique and system analysis.

b) skills (k)

1. Is able to recognize mechanical system problems, formulate the problem and select and apply the solution method.
2. Is able to solve simple systems analysis type problems numerically.

c) attitude (a)

1. Is interested in learning more about technical issues related to mechanical systems.
2. Is interested in new technical solutions in the field.

d) autonomy and responsibility (o)

1. Expresses independent opinions on issues related to the analysis of mechanical systems and the management of systems.
2. Takes responsibility for the adequacy of the procedures he applies.

24. Midterm assessments

Name	Code	Share in final grade	Evaluated learning outcomes
1. midterm test 2. midterm test	1. ZH1 2. ZH2	1. 50% 2. 50%	1. t1-4,k1-2,a1-2,o1-2 2. t1-4,k1-2,a1-2,o1-2

25. Exams

Name	Code	Share in final grade	Evaluated learning outcomes

26. Criteria to obtain a signature / midterm grade

The condition for obtaining at least a pass mid-term grade is: at least appropriate completion of each of the two midterm tests. The condition for qualifying as pass is the full fulfillment of the expected learning outcomes.

27. Grading rules

Excellent 88-100%
Good 75-87%
Satisfactory 62-74%
Pass 50-61%
Fail 0-49%

28. Attendance and participation requirements

according to the rules of CoS

29. Retake and delayed completion

The midterm tests can be repair separately one by one during the study period and the late completion period.

30. Consultation

at a time and in a form agreed with the teacher

31. Learning materials

Zobory I.: System technique and analysis (in Hungarian). Department notes, 2011., presentation slides

32. Start of validity for the subject decription

September 1st, 2025

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
Faculty of Transportation Engineering and Vehicle Engineering

Subject description

1. Subject name	**Vehice operation, reliability, and diagnositcs**				
2. Subject name in Hungarian	Járműüzem, megbízhatóság és diagnosztika			**3. Programme**	AJKL
4. Subject code	**BMEKOVJMsM8001-00**			**5. Term | role**	**- | szk**
6. Credits	**3**	**7. Evaluation type**	**m**	**8. Nature**	**contact lessons**
9. Weekly contact hours	**2 lecture**	**0 practice**	**0 laboratory**	**10. Language**	**HU EN**
11. SDG Learning outcomes' contribution to the EU/UN sustainable development goals					
12. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for lessons**	12 hours	**Homework**	0 hours
Reading written materials	22 hours	**Midterm preparation**	28 hours	**Exam preparation**	0 hours

13. Organisational unit in charge	Department of Railway Vehicles and Vehicle System Analysis		
14. Subject coordinator and its position	Dr. Tulipánt Gergely associate professor	**15. Email address**	tulipant.gergely@kjk.bme.hu
16. …organisational unit	Department of Railway Vehicles and Vehicle System Analysis		
17. Instructor(s)	Dr. Zábori Zoltán, Németh István		
18. Indicative prerequisites	- - -, - - -, - - -		

19. Purpose

Studying the timeline of vehicle operation, the technical environment of maintenance, energy, materials and information, the probability calculation basics of vehicle reliability theory, as well as getting to know the practical methods of vehicle reliability analysis, as well as block diagram and fault tree analysis, and solving design and operation problems with reliability theory methods.

20. Programme of lectures

Chronology, maintenance-, energetic-, mass- and info technical environment of the vehicle operation. Basics of probability analysis of vehicle reliability. Practical methods to analysing the vehicle reliability: block-diagram and fault-tree analysis. Solving of the design and operation problems using the methods of the reliability-theory. Data collection and information systems which are the basis of the vehicle reliability analysis. Specialities of the up-to-date RCM systems. Analysis of the vehicle servicing systems by semi-Markovian approach, negotiation of the questions of the mass service and storage sytems. Basis of the vehicle system diagnostic: the observation, the measurement, the automatic diagnostic evaluation, the statement of the operability. Using the databases based on system technical simulation to authorise the operation of the vehicles which are have suitable for transportation-safety criterions technical conditions. Exploring of the weaknesses by using diagnostic test.

21. Programme of practices

-

22. Programme of laboratories

-

23. Learning outcomes (lower case) and their link to the traning programme's learning outcomes (upper case)

The student

a) knowledge (t)

1. Understands and applies mathematical and scientific principles and procedures related to vehicle operation and reliability.
2. Understands and widely applies theories and terminologies developed in the field of vehicle operation, reliability and diagnostics.
3. Knows and understands the basic facts, limits and development opportunities of vehicle operation, reliability and diagnostics.
4. Knows and understands the transport, logistics, environmental, work and fire protection aspects related to vehicle operation.
5. Knows and understands the information and communication technology related to vehicle operation, reliability and diagnostics.
6. Knows and understands the methods of computer modeling and simulation related to vehicle operation, reliability and diagnostics.

b) skills (k)

1. Is able to apply the mathematical and natural science principles and procedures learned in an innovative way in solving problems related to vehicle operation, reliability and diagnostics.
2. Is able to analyze and evaluate methods applied in the field of vehicle operation, reliability and diagnostics.
3. Is able to apply integrated knowledge in the field of vehicle operation, reliability and diagnostics.

c) attitude (a)

1. Open and receptive to learning about and communicating development and innovation in the given field.
2. Has a deepened professional sense.
3. Assumes the professional and ethical values related to the technical field.
4. Strives to approach processes in a complex way based on a systems approach.

d) autonomy and responsibility (o)

1. Takes initiative in his/her professional work, independently selects and applies solution methods.
2. Makes decisions carefully and with responsibility.
3. In its decisions, takes into account environmental, safety, economic and engineering ethics regulations

24. Midterm assessments

Name	Code	Share in final grade	Evaluated learning outcomes
1. midterm test 2. midterm test	1. ZH1 2. ZH2	1. 50% 2. 50%	1. t1-6,k1-3,a1-4,o1-3 2. t1-6,k1-3,a1-4,o1-3

25. Exams

Name	Code	Share in final grade	Evaluated learning outcomes

26. Criteria to obtain a signature / midterm grade

The condition for obtaining at least a pass mid-term grade is: at least appropriate completion of each of the two midterm tests. The condition for qualifying as pass is the full fulfillment of the expected learning outcomes.

27. Grading rules

Excellent 88-100%
Good 75-87%
Satisfactory 62-74%
Pass 50-61%
Fail 0-49%

28. Attendance and participation requirements

according to the rules of CoS

29. Retake and delayed completion

The midterm tests can be repair separately one by one during the study period and the late completion period.

30. Consultation

at a time and in a form agreed with the teacher

31. Learning materials

Zobory I.: Vehicle operation, reliability, and diagnostics (in Hungarian). University notes, Budapest, 2010.

32. Start of validity for the subject decription

September 1st, 2025