Budapest University of Technology and Economics

Faculty of Transportation Engineering and Vehicle Engineering

PhD Programme

Curriculum

Valid from September 2019

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

PhD Curriculum

	Semester								Total
	1	2	3	4	Complex Exam	5	6	7	8	
Research Methodology	3									3
Basic Subjects	4	4	4	4						16
Specific Subjects	5	5	5	5						20
Teaching Activity	6	6	6	6		4				28
Research Progress Report	5	5	5	5		5	5	5	5	40
Research Activity	10	10	10	10						40
Publication Activity			5	5		26	20	10		66
Thesis preparation							10	10	10	30
Sum of credits	33	30	35	35		35	35	25	15	243

Course description explanation

1. Subject name	official name of the subject
2. Subject name in Hungarian	official name of the subject in Hungarian
3. Role	role of the subject in the curriculum: Basic course, Specific course, Mandatory
4. Code	Neptun code of the subject (with BME prefix)
5. Evaluation type	type of academic performance assessment, e – exam grade; m - mid-term grade; s – signature
6. Credits	credit value of the subject
7. Weekly contact hours	number of weekly (term-based) teaching hours for students by lecture, practice and lab
8. Curriculum	master programs related to the subject,: D – PhD curriculum
9. 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
10. Department	name of responsible department for managing the subject
11. Responsible lecturer	name of the person in charge of the subject (subject coordinator)
12. Lecturers	name of all lecturers of the subject
13. Prerequisites	predefined criteria for registering the subject
14. Desciption of lectures	detailed content of the lecture type course
15. Description of practices	detailed content of the practice type course
16. Description of laboratory practices	detailed content of the laboratory practice type course
17. Learning outcomes	results to achieve at the end of the learning process, grouped by competence
18. Requirements	requirements for passing the subject, aspects of performance evaluation, way to determine a grade (obtain a signature)
19. Retake and delayed completion	opportunity for repeat/retake and delayed completion
20. Learning materials	notes, textbooks, suggested literature, recommended learning support materials in printed or electronic form

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

Subject description

1. Subject name	**Advanced CFD in Vehicle Industry**				
2. Subject name in Hungarian	Járműipari áramlásmodellezés			**3. Role**	Basic course
4. Code	**BMEKORHD005**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**2 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**56 hours**
Contact hours	56 hours	**Preparation for seminars**	hours	**Homework**	hours
Reading written materials	hours	**Midterm preparation**	hours	**Exam preparation**	hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Veress Árpád
12. Lecturers	Dr. Veress Árpád

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Specific areas of the application of numerical methods in the vehicle engineering: Fluid dynamics in the vehicle industry, Supersonic internal and external flows, Secondary flows in turbo machinery and coupled flow and thermal processes, Rotors and propellers, Particle tracking, Free surface flows, Combustion in gas turbine combustor, Flow and thermal processes of PCBs, Flow in porous media. The material requires the knowledge of the next topics: Introduction to CFD (Computational Fluid Dynamics) via scientific and industrial applications, Approaches for flow modelling and conditions for applications, Flow modelling by means of continuum mechanics, System of Navier-Stokes equations, The subject of the CFD; actuality, advantages and application areas, Turbulence and simulation techniques for handling turbulence (DNS, LES and RANS), Reynolds and Favre averaged system of Navier-Stokes equations, Reynolds stress and Eddy viscosity models, Turbulence modelling, Modelling approaches close to the wall; logarithmic-based Wall function and Near-wall resolving approach, Placement of the first cell at the wall, Turbulence modelling, Introduction to discretization techniques (Finite Difference, Finite Element and Finite Volume Methods), Finite volume method for solving governing equations, The main steps of a CFD simulation tasks; geometry model preparation and simplification, meshing and mesh metrics, definition of material properties, setting of considered physics, initial and boundary conditions and their definitions, solver settings, convergence characteristics, visualization and presentation of the results in qualitative and in quantitative manner.

15. Description of practices

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16. Description of laboratory practices

Completing tutor-guided simulation tasks in ANSYS CFX environment: Flow modelling in nozzle of rocket engine, CFD analysis of aircraft wing profile, Numerical simulation of centrifugal compressor, Flow modelling in axial turbine, CFD analysis of X33 re-entry vehicle, Flow modelling of rotors and propellers, Numerical modelling of particle tracking, CFD analysis of free surface flows, Flow modelling in combustion chamber of gas turbine, Coupled CFD and thermal analysis of PCBs for thermal management, Flow in porous media.

17. Learning outcomes

a) Knowledge:

- The student knows the advantages, conditions, application ranges and the theoretical and practical aspects of the specific CFD (Computational Fluid Dynamics) methodologies for solving industrial (R&D) problems and for having new scientific results.

b) Ability:

- The student can solve CFD simulation tasks independently in the specific areas with especial care for the highest level approximation of the reality and/or at the best “computational cost/accuracy” ratio with verification, plausibility check and validation.
- The student can develop and obtain new industrial and scientific results after understanding and analysing CFD results.

c) Attitude:

- The student aims to complete his/her studies at the highest level, under the shortest time, by providing his/her knowledge and capacity at the best to obtain knowledge for deep and independent professional work.
- The student has strong professional commitment, has developed expectations for finding new, better solutions and has agreement on doing hard work.

d) Autonomy and responsibility:

- The student takes responsibility for guiding mates by the quality of his/her work and by keeping ethic norms.
- The student takes responsibility for applying the knowledge in line with the studied conditions, limitations and constraints.
- The student can friendly accept the well-established constructive criticism and can utilize that in future.
- The student is a creative constructor, proactive, and has leadership skills and argument techniques, capabilities with responsibility during the studies, research work.

18. Requirements, way to determine a grade (obtain a signature)

The criterion of the acceptance of the semester and so getting the signature is the completeness of the solution of a defined problem in a specific area in the agreed time and quality. The exam is oral. The final mark of the exam is the mathematical average of the results for the own task and the exam.

19. Retake and delayed completion

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20. Learning materials

1. The presentation about the lectures, simulation guide lines and tutorials provided by the professor,
2. John D. Anderson, JR.: Computational Fluid Dynamics, New York, ISBN-10: 0071132104, ISBN-13: 978-0071132107, McGraw-Hill Higher Education; International edition (1995),
3. ANSYS, Inc., ANSYS CFX-Solver Theory Guide, Release 2019 R1, ANSYS, Inc. Southpointe, 2600 ANSYS Derive Canonsburg, PA15317, ansysinfo@ansys.com, http://www.ansys.com, USA, 2019.

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

Subject description

1. Subject name	**Advanced theory of flight I. Aerodynamics**				
2. Subject name in Hungarian	Advanced theory of flight I. Aerodynamics			**3. Role**	Basic course
4. Code	**BMEKOVRD002**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	20 hours	**Homework**	10 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	24 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács József
12. Lecturers	Dr. Rohács József

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

A.) Basic aerodynamics. Lift generation. Boundary layer theory. Drag and its components. Aerodynamics coefficients. Theory of profiles. Theory of finite wing. Aerodynamics of 3D bodies. Subsonic, transonic and supersonic aerodynamics. Polar curve calculations, aircraft aerodynamic design.

B.) Advanced aerodynamics. Flow control. Laminar wing. Airframe – propulsion system integration. Control of the flow separation. Non-steady aerodynamics. Aerodynamics of flexible wings. Morhing. Biomimicry. Models of the aerodynamics coefficients. Numerical aerodynamics. Measuring the aerodynamic coefficients. Identification of models of aerodynamic coefficients. Role of aerodynamics in aircraft conceptual design.

15. Description of practices

PhD studentt have not studied the aerodynamics earlier must perform aerodynamic calculation/ design of an aircraft, systematic consultancy on a special project and working individually on proposal or contribution an article

16. Description of laboratory practices

As it required for performing the practical works.

17. Learning outcomes

a) Knowledge and Ability:

- Increasing knowledge in aerodynamics; developing the competence in understanding, measuring, calculation and predicting the aerodynamic characteristics; developing knowledge and competence in aerodynamic design.

18. Requirements, way to determine a grade (obtain a signature)

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19. Retake and delayed completion

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20. Learning materials

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

Subject description

1. Subject name	**Advanced theory of flight II. Flight mechanics, flight dynamics and control**				
2. Subject name in Hungarian	Advanced theory of flight II. Flight mechanics, flight dynamics and control			**3. Role**	Basic course
4. Code	**BMEKOVRD003**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	20 hours	**Homework**	10 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	24 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács József
12. Lecturers	Dr. Rohács József

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

C.) Flight mechanics. Required and available thrust / power. Take-off and landing. Cruise flight. Descent. Range and endurance. Flight performance. Flight and load envelops. Energetic approach in trajectory optimisation. Stability and controllability. Static longitudinal flights.

D.) Flight dynamics and control. System of equation of motion. Longitudinal and lateral motion. Effects of manoeuvres and gusts. Dynamic stability. Controllability. Supermanoeuvrability. Thrust vectored control. Bifurcation analysis. Chaos in aircraft dynamics. Control of flexible bodies. Load management. Flight simulations. Calculation and estimation of the aerodynamic coefficient from the in-flight measurements. Automatic control. New control methods: adaptive, reconfigurable methods, methods based on the biological principles, formation flights, etc. Autonomous systems. Flight of UAV, drones. Pilot in loop. Less skilled pilots. Pilot subjective decisions.

15. Description of practices

PhD student have not studied the flight mechanics, flight dynamics and control earlier must perform a homework, namely calcualtion or simulation studies of flight performance stability and controllability of an aircraft. Systematic consultancy on a special project and working individually on proposal or contribution an article.

16. Description of laboratory practices

As it required for performing the practical works.

17. Learning outcomes

a) Knowledge and Ability:

- Increasing knowledge in flight mechanics, flight dynamics and control; developing the competence in understanding, measuring, calculation, simulation and predicting the flight performance, characteristics of flight dynamics, stability and aircraft controllability.

18. Requirements, way to determine a grade (obtain a signature)

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19. Retake and delayed completion

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20. Learning materials

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

Subject description

1. Subject name	**Air Transport Management (PhD)**				
2. Subject name in Hungarian	Légiközlekedési management PhD			**3. Role**	Specific course
4. Code	**BMEKOKGD010**	**5. Evaluation type**	**m**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	56 hours	**Preparation for seminars**	0 hours	**Homework**	20 hours
Reading written materials	10 hours	**Midterm preparation**	4 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Kővári Botond
12. Lecturers	Dr. Kővári Botond

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Critical analysis of the structure of the aviation market; trends in the development of the types of company; operational management development solutions with innovative capabilities; treatment of disorders - identification of regularities; exploring the regularities of external influences in aviation. Independent critical analysis of aviation legislation. Errors in aviation development forecasts. Innovative business models for aviation.

15. Description of practices

Literature research in a topic discussed with the lecturer, and write and present a seminar paper.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Familiar with actors of air transportation, and with the basic principles of management and economic issues of airlines.

b) Ability:

- Ability to analyze a market, evaluate an airline with a market aspect.

c) Attitude:

- Strive to acquire the highest level of system approach.

d) Autonomy and responsibility:

- Responsible applies of acquired knowledge in individual or in team work.

18. Requirements, way to determine a grade (obtain a signature)

1 test, 1 shorter homework.

19. Retake and delayed completion

Second test possibility for those not present on the test, possibility of delayed deadline for home work.

20. Learning materials

Suggested books and papers.

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

Subject description

1. Subject name	**Analitical Methots in System Technique I.**				
2. Subject name in Hungarian	Analitikus módszerek a rendszertechnikában I.			**3. Role**	Basic course
4. Code	**BMEKOVJD001**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	15 hours
Reading written materials	15 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Zobory István
12. Lecturers	Dr. Zobory István

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Sets. Basic number sets. Numerical sequences and numerical series. Convergency. Defining functions. Description of functions. Multivariate functions. Limit value, continuity and differentiability. Concept of Riemann-integral. Convergency concepts. Important function series: Taylor-series and Fourier-series. Basic numerical methods. Polynomial interpolations. Lagrange-interpolation, Hermite-interpolation and spline-interpolation. The method of least square. Numerical solution to algebraic equations. Method of intervallum-dividing. String-method. Section method. Tangent method. Successive approximation. Numerical integration. The Newton-Cotes procedure. The trapeze-rule. The Simpson-trule. Linear algebra and matrix calculus. Linear space. Linear sub-space. Linear independence. Generator-system. Basis. Scalar product. Ortogonality. Norma.Metric space. Matrices and vectors. Standard basis. Description of the elements of the linear space by using different bases. Homogeneous linear mappings and their matrices. Rang of matrices. Basis-dependence of the matrix of a linear mapping. Matrix product. Determinants. Inverse matrix. Linear set of equations. Condition of solvability based on the rang of the coefficient matrix. The Gaussean algorithm. Improvement of the accuracy. Iterative methods. The accelerating algorithm of Seidel. Treatment of contradictory (principally not solvable) set of equations.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: examination procedures of single variate and multivariate functions; procedures for interpolation and numerical integration; methods of linear mapping; operations of matrix algebra; methods of solution to linear system of equations.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Accepted homework sent before the deadline and written exam.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Zobory, I.: Analitikus módszerek a rendszertechnikban I. Egyetemi jegyzet. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
Rudin, W.: A matematikai analízis alapjai. Tipotex Kft., Budapest, 2010.

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
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Subject description

1. Subject name	**Analitical Methots in System Technique II.**				
2. Subject name in Hungarian	Analitikus módszerek a rendszertechnikában II.			**3. Role**	Basic course
4. Code	**BMEKOVJD002**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	0 hours
Reading written materials	30 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Zobory István
12. Lecturers	Dr. Zobory István

13. Prerequisites	Analitical Methots in System Technique I. (BMEKOVJD001), recommended; - (-), -; - (-), -

14. Description of lectures

Algebraic and trigonometric form of complex numbers. Euler-relation. Defining complex functions. The complex function as mapping. Differentiability of complex functions. The Caucy-Riemann differential equations. Integration of complex functions. Integral theorems. Integration along a given curve with respect to arclength. Harmonic functions. Elements of Laplace- and Fourier transform. The concept and classification of differential equations. The general initial value problem. The equivalent integral equation. The Picard-Lindelöf iteration. The Lipschitz condition. Tracing back higher order differential equations to a first order set of differential equations. Solution methods for treating linear differential equations. Application of Laplace transform for the solution of differential equations. Numerical solution to differential equations: The Euler-method, the Heun-method, the Runge-method and the Runge-Kutta method. Differential-equation systems. Solution to the homogeneous part of the linear differential equation via treating an eigenvalue-problem. Test function method for the solving inhomogeneous set of differential equations. The general solution and the particular solutions. Tracing back higher order differential equation systems to a first order linear differential equation system. Numerical solution to differential equation systems. Stability of the solution to differential equations and differential equation systems in the case of perturbing the initial values or the coefficients. Stability analysis for linear differential equations, the Hurwitz-criterion. Stability analysis for non-linear differential equations. The method of Ljapunov.. Construction of Lajapunov functions. The basic lemma of the variation calculus. The Euler-Lagrangean equation. Direct methods of the variation calculus. Euler-method based on broken lines. The Ritz-method.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: relationships in komplex function theory; analitical and numerical solution methods to linear or non linear differential equations and equation systems; methods of function variation theory.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Regular participation at the lectures and written exam.

19. Retake and delayed completion

According to the TVSZ.

19. Learning materials

Zobory, I.: Analitikus módszerek a rendszertechnikban II. Egyetemi jegyzet. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
Brown, F.T.: Engineering System Dynamics. Taylor & Francis, Boca Raton, London, New-York, 2007

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

Subject description

1. Subject name	**Analitical Methots in System Technique III.**				
2. Subject name in Hungarian	Analitikus módszerek a rendszertechnikában III.			**3. Role**	Basic course
4. Code	**BMEKOVJD003**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	0 hours
Reading written materials	30 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Zoller Vilmos
12. Lecturers	Dr. Zoller Vilmos

13. Prerequisites	Analitical Methots in System Technique I. (BMEKOVJD001), recommended; Analitikus módszerek a rendszertechnikában II. (BMEKOVJD002), recommended; - (-), -

14. Description of lectures

In the main part linear partial differential equations. First order equations. The solution as an integral-manifold. Homogeneous and non-homogeneous equations. Characteristic curve, characteristic equation. First order partial differential equations. Constant coefficient linear partial differential operator with complex coefficients. The Cauchy-Riemann operator. In the main part linear second order partial differential equations. Classification. Constant coefficient second order partial differential equations. Hyperbolic type equations. The wave operator. Parabolic type equations. Thermal operator. Schrödinger operator. Fourth order operators: Euler-Bernoulli, Rayleigh and Timoshenko beam operators. Elliptic type equations. Initial value and Boundary value problems. The Fourier method. Basic concepts of topology. Generalisation of the metric space, the topologic space. Local convexity. The space of basic functions. Distributions. Direct product. Convolution. Fourier transform of distributions. Basic solutions. Linear differential operator of constant coefficient. First order case. The wave operator. Klein-Gordon equation. Basic solution to the wave-equation. Basic solution for the thermal operator. Basic solution for the Cauchy-Riemann operator. Basic solution for the Laplace operator, connection with the Poisson equation. Basic solution for the Helmholtz operator.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: solution methods of partial differential equations; procedures of topology and distribution theory; application methods of Laplace transformation and Fourier operator.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Regular participation at the lectures and written exam.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Zoller, V.: Analitikus módszerek a rendszertechnikban III. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2013.
Brown, F.T.: Engineering System Dynamics. Taylor & Francis, Boca Raton, London, New-York, 2007

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
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Subject description

1. Subject name	**Analytical mechanics**				
2. Subject name in Hungarian	Analitikus mechanika			**3. Role**	Basic course
4. Code	**BMEKOJSD001**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**1 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	42 hours	**Preparation for seminars**	14 hours	**Homework**	28 hours
Reading written materials	12 hours	**Midterm preparation**	0 hours	**Exam preparation**	24 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Béda Péter
12. Lecturers	Dr. Béda Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Structure and classification of mechanical systems. Constraints. Lagrange equations of second kind. Hamilton's canonic equations of motion. First integrals of motion. Routh-Voss equations. Cyclic coordinates, hidden motions. Critical velocity of shafts, giroscopic effect.

15. Description of practices

Examples from the topics of the lessons.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- Methods of the analytical mechanics.

b) Ability:
- Analytical description of a mechanical system, model building.

c) Attitude:
- Being open to understand and learn novelties on that given domain.

d) Autonomy and responsibility:
- Evaluation and choice of optimal model elements.

18. Requirements, way to determine a grade (obtain a signature)

Semester note upon succesful realisation of the homework and an oral exam.

19. Retake and delayed completion

Essay secondary deadlines precised in the lessons requirements.

20. Learning materials

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

Subject description

1. Subject name	**Application of AI in vehicle industry PhD**				
2. Subject name in Hungarian	Neurális hálók járműipari alkalmazása			**3. Role**	Specific course
4. Code	**BMEKOGGD805**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	14 hours	**Preparation for seminars**	14 hours	**Homework**	12 hours
Reading written materials	20 hours	**Midterm preparation**	30 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Zöldy Máté
12. Lecturers	Dr. Zöldy Máté

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Artificial Intelligence is based on applications in the automotive industry. Machine Learning and Neural Networks for Homologization. Automotive AI Use Cases. Market barriers and challenges an AI forecasts for automotive applications in neural networks.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Is familiar with the images presented in the subject and the individual procedures of the internal relationships.

b) Ability:

- Capable of all procedures and research.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- A vehicle for solving research tasks.

18. Requirements, way to determine a grade (obtain a signature)

Knowing the curriculum and application of it. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Autonomous Vehicle Driverless Self-Driving Cars and Artificial Intelligence: Practical Advances in AI and Machine Learning

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

Subject description

1. Subject name	**Artificial Intelligence vehicles homologation process PhD**				
2. Subject name in Hungarian	Mesterséges Intelligencia alkalmazások homologációs folyamatai és mérései			**3. Role**	Specific course
4. Code	**BMEKOGGD803**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	14 hours	**Preparation for seminars**	14 hours	**Homework**	5 hours
Reading written materials	5 hours	**Midterm preparation**	22 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Zöldy Máté
12. Lecturers	Dr. Zöldy Máté

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Opportunities for developing technical intelligence, machine learning and neural networks. Novel challenges and innovative solutions to the homologation process. Self-check process and the challenges of Automotive AI and the emergence of novel laws. Explore possible solutions to standardize AI vehicle evaluation. Development of forecasts and forecasts.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

Knowledge:

- Is familiar with the images presented in the subject and the individual procedures of the internal relationships.

Ability:

- Capable of all procedures and research.

Attitude:

- Openness to new opportunities in the field.

Autonomy and responsibility:

- A vehicle for solving research tasks.

18. Requirements, way to determine a grade (obtain a signature)

Knowing the curriculum and application of it. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Self developed materials from the department.

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

Subject description

1. Subject name	**Automation of Production**				
2. Subject name in Hungarian	Gyártásautomatizálás			**3. Role**	Specific course
4. Code	**BMEKOGTD018**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**62 hours**
Contact hours	42 hours	**Preparation for seminars**	0 hours	**Homework**	0 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	12 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Takács János
12. Lecturers	Dr. Takács János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The aim of this subject to provide high-level knowledges from history and principles of automation of production, tools of flexible production, principles of operation of NC and CNC machines, functioning of the management and control systems, integration of system units. Connection between3D Measurement Technologies and automated production. Robots in integrated productions. PC-based factory integration.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Knows the concept, history, importance, effects and elements of automation.
- Knows the machines and subsystems of inflexible and flexible automation (NC, CNC, DNC).
- Has a deeper knowledge of NC machine construction: open and closed drive chains, control and regulation (point, ... track); positioning interpolation; absolute, incremental, mixed systems; sensors.
- Knows the basics of NC programming; AC (adaptive control).
- Knows material and tool management, warehousing and handling techniques (palettes, toolbars and exchangers, coding).
- Knows the structure, classification and application of industrial robots in automated production.
- Knows integrated manufacturing systems: CAD, CAM, CAPP, CIM, JIT group technologies; manufacturing cell, FMS (Flexible Manufacturing System).
- Knows the possibilities of integrating measurement technology into production.
- Has a deeper knowledge of the devices, structure, operation and accuracy of 3D measurement technology.

b) Ability:

- Able to overview the whole and the elements of a technological process and to plan it.
- Capable of a deeper, causal, scientific analysis of a technological process.
- Able to give suggestions for the development of a technological process.
- She/he is able to gather literature on a specific research topic and compile a summary based on it.
- Able to interpret the results found in the literature. Able to develop a suitable experimental method for a research topic and propose test methods.Able to interpret test results.

c) Attitude:

- She/he strives to develop his knowledge independently.
- Strives to explore the causal relationship with scientific depth.
- Strives to develop its own topic area.
  Strives to find connections between topics and disciplines.
- Strives to interpret the literature and their own research results independently and in teamwork, listening to others' thoughts.
- Strives to share her/his knowledge. Independence and responsibility:

d) Autonomy and responsibility:

- Apply responsibly the knowledge acquired during the course with regard to their validity limits.
- Manages and communicates the results of others and their own results also in accordance with ethical standards.
- Endeavors to perform his assigned tasks independently in accordance with ethical standards.
- She/he knows how far his responsibilities are, informs his colleagues or his supervisor about her/his results, and when it is necessary.

18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

Kalpakijan S.: Manufacturing Engineering and Technology, Prentice Hall, 2013.
Mikell P. Groover: Automation, Production Systems, and Computer-Integrated Manufacturing, Prentice Hall, 2007.
Colestock H.: Industrial Robotics, McGraw-Hill/TAB Electronics, 2005.

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

Subject description

1. Subject name	**Biometric identification in networked computer systems**				
2. Subject name in Hungarian	Biometrikai személyazonosítás számítógépes rendszerekben			**3. Role**	Specific course
4. Code	**BMEKOALD004**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	28 hours	**Preparation for seminars**	6 hours	**Homework**	8 hours
Reading written materials	2 hours	**Midterm preparation**	6 hours	**Exam preparation**	10 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Szirányi Tamás
12. Lecturers	Dr. Szirányi Tamás

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The aim of the course is to provide students with independent observance of regularities in the following semester: principles of operation of personal identification systems, engineering feasibility and practical systems; complex identification systems for intelligent vehicles, operational interfaces, computer security systems; measurable physical characteristics of individuals; legal issues in biometrics.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Knowing the biometrics of persons and their mathematical description.
- Having comprehensive knowldege about the topic of fingerprint identification.
- Knowing the mathematical methods of face recognition.
- Knowing the basics of shape recognition. Knowing the basic properties of recognition based on iris and retina.
- Knowing the topic of hand and handwriting recognition.
- Knowing the identification based on DNA.
- Knowing the topics of gait recognition, identification based on typewriting and dynamic features.
- Has comprehensive knowledge about complex identification systems.
- Being able to apply the knowledge in tasks related identification and recognition.
- Application of decision making methods.
- Being able to apply of different shape recognition algorithms.
- Being able to solve recognition problems based on biometrics.
- Being able to solve the problems alone or in group and efficiently transfer the knowledge. Having original/innovative ideas.

b) Attitude, Autonomy and responsibility:

- Working efficiently alone and in group.
- Seeking for relations to other subjects.
- Being open to use mathematical and informatic tools.
- Seeking to know and learn the neccesary tools.
- Seeking to solve the problems accurately and error-free.
- Finding solutions alone.
- Taking into considereations the effects of the decisions.
- Applying systematic approach.

18. Requirements, way to determine a grade (obtain a signature)

The evaluation of the learning results is based on the written (homework) and oral (oral exam) performance. The homework can be corrected until the end of the week of examinations.

19. Retake and delayed completion

The oral exam can be re-take first free of charge. The second and higher re-take of the same subject has charge regulated by the university.

20. Learning materials

Online notes provided by the department; Anil K. Jain, Patrick Joseph Flynn, Arun A. Ross: Handbook of Biometrics, ISBN 978-0-387-71040-2.

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

Subject description

1. Subject name	**Calibration and homolagtion of ADAS systems**				
2. Subject name in Hungarian	ADAS rendszerek kalibrációja és jóváhagyása			**3. Role**	Specific course
4. Code	**BMEKOGGD004**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	14 hours	**Preparation for seminars**	18 hours	**Homework**	5 hours
Reading written materials	5 hours	**Midterm preparation**	18 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Zöldy Máté
12. Lecturers	Dr. Zöldy Máté

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Independent analysis of vehicle dynamics processes in the light of the driving process. Development of management support systems, detection of its expected tendency. Development of automotive calibration and homologation process. Calibration and development of ADAS systems. Design and development of homologation of ADAS systems.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Is able to independently develop the procedures presented in the subject and the internal relationships within the procedures.

b) Ability:

- Ability to research and develop in specific processes.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- Get involved in research tasks.

18. Requirements, way to determine a grade (obtain a signature)

Knowing the curriculum and application of it. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Self developed materials from the department.

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

Subject description

1. Subject name	**Continuum Mechanics**				
2. Subject name in Hungarian	Kontinuum mechanika			**3. Role**	Basic course
4. Code	**BMEKOMED030**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**1 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	42 hours	**Preparation for seminars**	14 hours	**Homework**	28 hours
Reading written materials	12 hours	**Midterm preparation**	0 hours	**Exam preparation**	24 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Béda Péter
12. Lecturers	Dr. Béda Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Motion law, shape modification gradient and tensors. State of velocity, state of acceleration. Time derivatives of material. Shape variation velocity and vortex tensor. Transformation of surface element and volume element of a material. State of stress, stress tensors. Cauchy's motion equations of I and II kind. Mass conservation, continuity. Basics of thermodynamics. Principle of virtual work. Objective time derivative. Theroy of material laws. Fluids. Elastic, hipoelastic and hiperelastic bodies, elasto-plastic bodies.

15. Description of practices

Examples from the topics of the lessons.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- Methods of the continuum mechanics.

b) Ability:
- Description of a mechanical system in time domain, model building.

c) Attitude:
- Being open to understand and learn novelties on that given domain.

d) Autonomy and responsibility:
- Evaluation and choice of optimal model elements.

18. Requirements, way to determine a grade (obtain a signature)

Semester note upon succesful realisation of the homework and an oral exam.

19. Retake and delayed completion

Essay secondary deadlines precised in the lessons requirements.

20. Learning materials

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

Subject description

1. Subject name	**Controlled vehicle system dynamics I. PhD**				
2. Subject name in Hungarian	Szabályozott járműdinamikai rendszerek I. PhD			**3. Role**	Specific course
4. Code	**BMEKOGJD010**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	22 hours
Reading written materials	26 hours	**Midterm preparation**	30 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Tihanyi Viktor

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

"Regulated Vehicle Dynamics Systems I." students will delve deeper into the areas of development of electronically controlled vehicle dynamics systems used in motor vehicles, as well as the intelligent vehicle systems researched today and their current dynamics and control technology background. The aim is to develop control technology solutions used in modern vehicle technology. Special control technology issues and novel regularities of active and semi-active vehicle suspension systems. Critical evaluation of control strategies for ABS / ASR systems. Development of control theory problems in automotive driver assist systems (active speed control, lane departure detection)

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Familiar with vehicle dynamics fundamnetals.

b) Ability:

- Ability to research and develop specific processes.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

The acquisition of the signature of the subject, and, in addition, the condition of taking exam is giving in the complete individual student homework for deadline. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Hans Pacejka: Tire and Vehicle Dynamics, Elsevier B-ELS-049, ISBN of 9780080970172, 2012.
Tire and Wheel Technology, 2011, SAE International SP-2296, ISBN of 978-0-7680-4735-6, 2011.
Vehicle Dynamics Stability and Control, 2011, SAE International SP-2297, ISBN of 978-0-7680-4736-3, 2011.
Rao V. Dukkipati, Jian Pang, Mohamad S. Qatu, Gang Sheng, Zuo Shuguang, Road Vehicle Dynamics, SAE International, R-366, ISBN of 978-0-7680-1643-7, 2008.

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

Subject description

1. Subject name	**Controlled vehicle system dynamics II. PhD**				
2. Subject name in Hungarian	Szabályozott járműdinamikai rendszerek II. (PhD)			**3. Role**	Specific course
4. Code	**BMEKOGJD001**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	22 hours
Reading written materials	26 hours	**Midterm preparation**	30 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Controlled vehicle system dynamics I. PhD (BMEKOGJD010), strong; - (-), -; - (-), -

14. Description of lectures

Our students can effectively use the knowledge of this subjects during their research on modern, electronically controlled vehicle dynamics systems.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- Familiar with vehicle dynamics fundamnetals.

b) Ability:
- Ability to research and develop specific processes.

c) Attitude:
- Openness to new opportunities in the field.

d) Autonomy and responsibility:
- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

The acquisition of the signature of the subject, and, in addition, the condition of taking exam is giving in the complete individual student homework for deadline. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Hans Pacejka: Tire and Vehicle Dynamics, Elsevier B-ELS-049, ISBN of 9780080970172, 2012.
Tire and Wheel Technology, 2011, SAE International SP-2296, ISBN of 978-0-7680-4735-6, 2011.
Vehicle Dynamics Stability and Control, 2011, SAE International SP-2297, ISBN of 978-0-7680-4736-3, 2011.
Rao V. Dukkipati, Jian Pang, Mohamad S. Qatu, Gang Sheng, Zuo Shuguang, Road Vehicle Dynamics, SAE International, R-366, ISBN of 978-0-7680-1643-7, 2008.

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

Subject description

1. Subject name	**Data collection and evaluation systems PhD**				
2. Subject name in Hungarian	Mérő- és Adatgyűjtő Rendszerek PhD			**3. Role**	Basic course
4. Code	**BMEKOGED007**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	7 hours	**Homework**	26 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	21 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Classification and choice of measurement procedures. Role of the measurements in the modern structure design process. Presentation of the measurement theory and process for photoelastic coatings, evaluation of results. Test measurements on models and real structures. Application for fracture mechanics. Measurement processes for polimers and composites. Applications in biomechanics. Strain measurement processes, tools, evaluation. Measurement of residual stresses.

15. Description of practices

Planning and preparation of measures on structures, based on the lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- Measurement processes, methods.

b) Ability:
- Preparation and realisation of measurements.

c) Attitude:
- Being open to understand and learn novelties on that given domain.

d) Autonomy and responsibility:
- Evaluation and choice of optimal model elements.

18. Requirements, way to determine a grade (obtain a signature)

Semester note upon the essay, the presentation and a written exam.
Presentation and essay secondary deadlines precised in the lessons requirements.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

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

Subject description

1. Subject name	**Decision making methods**				
2. Subject name in Hungarian	Döntéselőkészítési módszerek a közlekedésben			**3. Role**	Specific course
4. Code	**BMEKOKKD008**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	42 hours	**Preparation for seminars**	6 hours	**Homework**	8 hours
Reading written materials	10 hours	**Midterm preparation**	12 hours	**Exam preparation**	12 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Békefi Zoltán
12. Lecturers	Dr. Békefi Zoltán

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The student is able to apply linear programming, sensitivity analysis, target programming, network analysis, dynamic programming, game theory methods in a narrower field of his / her own research, and to explore new relationships with the help of these models.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- The student gets acquainted with the principal mathematical modeling methods.

b) Ability:

- The student will be able to identify and solve decision problems.

c) Attitude:

- During the optimization processes the student strives for the integrated handling of the technical and economical aspects of the problems.

d) Autonomy and responsibility:

- The student is able to make independent analyzis and evaluation activities.

18. Requirements, way to determine a grade (obtain a signature)

Two tests must be passed during the semester, and a presentation must be prepared and presented. The semester note is the average of these three results.

19. Retake and delayed completion

Midterm tests can be retaken till end of delayed completion period.

20. Learning materials

Hillier, F.S. – G.J. Lieberman: Introduction to Operations Research

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

Subject description

1. Subject name	**Design and examination of materials handling machines**				
2. Subject name in Hungarian	Anyagmozgatógépek tervezése és vizsgálata			**3. Role**	Specific course
4. Code	**BMEKOEAD002**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**48 hours**
Contact hours	28 hours	**Preparation for seminars**	4 hours	**Homework**	8 hours
Reading written materials	4 hours	**Midterm preparation**	4 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bohács Gábor
12. Lecturers	Dr. Bohács Gábor

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The subject aims to present special design tasks of material handling machines. Typical sources of malfunction and the methods for examination is also discussed. Detailed presentation is made for machines of bulk materials. Further materials handling machines design methods for piece goods is also taken (forklifts, cranes). Special attention is made for the transfer and interfacing problems of the machines. Finally future development of material handling is dscussed.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Knowledge of the special structural elements of material handling machines.
- Knowledge of the loads caused by the moving material and the operation.
- System engineering of material handling machines.

b) Ability:

- Is capable of correctly dimensioning mechanical handling components.
- Able to fit material handling machine components into an optimal system.

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The grade is calculated from the grade of the individual work and the tests as an average.

19. Retake and delayed completion

Announced at the beginning of the semester

20. Learning materials

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

Subject description

1. Subject name	**Design of Transport Information Systems (PhD)**				
2. Subject name in Hungarian	Közlekedési rendszertervezés (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKUD007**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for seminars**	8 hours	**Homework**	8 hours
Reading written materials	6 hours	**Midterm preparation**	28 hours	**Exam preparation**	12 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Mándoki Péter
12. Lecturers	Dr. Mándoki Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Transportation Information systems planning methods and techniques. Steps to survey, record, and analyze the information system. System concept and system design. Planning the change-over between information systems. Documentation of system design, presentation of documentation procedures. Analysis of complex system design procedures. SDM Methodologies, SSADM, Euromethod. Computer Supported Information System Design Procedures (CASE Tools). Agilis system planning methods.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- The student knows and understands transport system design process, know the different development methodologies.

b) Ability:

- Ability to dealing with creative problems in the field of transport informaiton system and flexible solutions to complex tasks.
- Able to plan a complex information system, taking into account their operational aspects.
- Able to working in a group, sharing tasks and managing them over time.

c) Attitude:

- Engages in professional and ethical values related to the technical field, and works based on a system-oriented and process-oriented mindset, in a team-work.

d) Autonomy and responsibility:

- Make his decisions carefully, in consultation with representatives of other fields of expertise, with full responsibility.

18. Requirements, way to determine a grade (obtain a signature)

Exam, which included the results of individual tasks 50% weighting.

19. Retake and delayed completion

Unsuccessful task can be replaced during the replacement period.

20. Learning materials

Uploaded materials to theMoodle System and the Department website.

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

Subject description

1. Subject name	**Development philosophies I. problems, new sciences, technologies, solution**				
2. Subject name in Hungarian	Development philosophies I. problems, new sciences, technologies, solution			**3. Role**	Basic course
4. Code	**BMEKOVRD004**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	20 hours	**Homework**	10 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	24 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács József
12. Lecturers	Dr. Rohács József

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

A.) Problems and their possible solutions. General problems, mathematical representation, economic problems, safety and security, environmental protection, time effects. Development of the individual, team and company competence. Brain and thinking. Thinking out of the box. Classification of technologies, disruptive technology development. Radically new solutions. Breakthrough innovation. Emerging technologies. Expectation and requirements to new technologies and solutions. Managing with stakeholders and societies.

B.) New sciences and technologies. Innovation theory, theory of innovation diffusion. Technology development, technology saving, technology transfer. Systems engineering. Evaluation, modelling and development of the systems. Large techno-ecological and technogen systems. Logistics. Lean technologies. Engineering and production process development. Production support systems. New technologies and solutions like MEMS (micro-electro-mechanical systems), smart technologies, solutions based on biological principles, biomechanics, biomimicry, etc.

15. Description of practices

Systematic consultancy and working individually on proposal or contribution an article.

16. Description of laboratory practices

As it required for performing the practical works.

17. Learning outcomes

a) Knowledge and Ability:

- Study the major problems required new solutions, understanding the original solutions and their developments; understanding the major features of disruptive technologies, breakthrough innovation and emerging technologies, developing knowledge and competences in implementation of new sciences supporting the developments.

18. Requirements, way to determine a grade (obtain a signature)

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19. Retake and delayed completion

-

20. Learning materials

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

Subject description

1. Subject name	**Development philosophies II. project and competence development**				
2. Subject name in Hungarian	Development philosophies II. project and competence development			**3. Role**	Basic course
4. Code	**BMEKOVRD005**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	20 hours	**Homework**	10 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	24 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács József
12. Lecturers	Dr. Rohács József

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

C.) Projects. NASA classification of the project life. Life cycle of the projects. Technology and product lives. General process of development. Development spiral. Evaluation of the science and technology development. Market needs and requirements analyses. Operational concept development. Conceptual design. Preliminary and detailed design. Product development and engineering. Influences of the market needs on the development. Goodness factor. Functional and economic goodness factors. Development philosophies: leader and follower developments, parallel developments. Interactions of market and developments. Success of technology, product and company developments. Identification, evaluation and selection of the new technologies. Technology readiness level, technology impact, technology compatibility, morphological, decision, etc. matrices. Impact analysis, total life cycle costs.

D.) Project and competence developments: Analyses of calls and tenders. Development and evaluation of the ideas. EU project support. Project initiating. Team completion. Preliminary works. Definition of goals and objectives. Description of methodology, dependences on other projects. Impacts. Development of the contents of technical, financial and other required parts (like ethics dissemination). Developing the work packages system. Description of team competences. Contribution of the proposal. Negotiation contracting. Project management. Definition of the competences. Knowledge development. Role of tacit knowledge. Competence development. Research competence developments. Writing the report, conference and journal articles.

15. Description of practices

Systematic consultancy and working individually on proposal or contribution an article.

16. Description of laboratory practices

As it required for performing the practical works.

17. Learning outcomes

a) Knowledge and Ability:

- Study the project development, increasing the knowledge and competences in design process management, understanding the design philosophies, developing the practical competences in project management and result disseminations

18. Requirements, way to determine a grade (obtain a signature)

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19. Retake and delayed completion

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20. Learning materials

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

Subject description

1. Subject name	**Digital Image Processing**				
2. Subject name in Hungarian	Képfeldolgozás			**3. Role**	Basic course
4. Code	**BMEKOALD002**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	12 hours	**Homework**	15 hours
Reading written materials	5 hours	**Midterm preparation**	12 hours	**Exam preparation**	20 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Szirányi Tamás
12. Lecturers	Dr. Szirányi Tamás, Rózsa Zoltán

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The aim of the course is to give students the opportunity to discover novel laws in one of the following topics: computer analysis, correction and processing of two- and three-dimensional images and videos; recognition and classification of figurative shapes; mathematical methods of image processing and evaluation, manipulation.

15. Description of practices

During the computer practice the students are programming and solving examples about the topic of the lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Knowing the processes and basic elements of image processing, enhancement and manipulation.
- Having comprehensive knowledge about the different topics of image acquisition.
- Knowing the computer description of images and basic propoerties.
- Knowing the basics of shape recognition. Knowing the basic properties of human vision.
- Knowing the principles of decision making.
- Having comprehensive about convolution and application areas.
- Knowing the methods of motion-analysis and tracking.
- Knowing the basic methods of texture characterization.
- Being able to apply the knowledge in tasks related to image processing, enhancement and manipulation.
- Application of decision making methods.
- Being able to apply of different shape recognition algorithms. Being able to solve tracking and motion analysis problems.
- Being able to solve the problems alone or in group and efficiently transfer the knowledge.
- Having original/innovative ideas.

b) Attitude, Autonomy and responsibility:

- Working efficiently alone and in group.
- Seeking for relations to other subjects.
- Being open to use mathematical and informatic tools.
- Seeking to know and learn the neccesary tools.
- Seeking to solve the problems accurately and error-free.
- Finding solutions alone.
- Taking into considereations the effects of the decisions.
- Applying systematic approach.

18. Requirements, way to determine a grade (obtain a signature)

The evaluation of the learning results is based on the written (homework) and oral (oral exam) performance. The homework can be corrected until the end of the week of examinations.

19. Retake and delayed completion

The oral exam can be re-take first free of charge. The second and higher re-take of the same subject has charge regulated by the university.

20. Learning materials

Online notes provided by the department; Bernd Jahne: Digital Image Processing, 5st edition, Springer, Heidelberg, 2002; W. K. Pratt: Digital Image Processing, Wiley, 2001.; Kató Zoltán, Czúni László: Számítógépes látás, Typotex, 2011

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

Subject description

1. Subject name	**Discrete event systems with traffic applications (PhD)**				
2. Subject name in Hungarian	Diszkrét eseményű rendszerek és közlekedési alkalmazásaik (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKAD015**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for seminars**	6 hours	**Homework**	24 hours
Reading written materials	6 hours	**Midterm preparation**	16 hours	**Exam preparation**	10 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Hangos Katalin
12. Lecturers	Dr. Hangos Katalin

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Basic concepts and techniques for describing discrete-event systems: discrete-event systems theory, Petri nets and automatons, qualitative difference equations, rules and rule systems with time-dependent predicates, inference and search, graph-type models, effect graphs. Solving discrete-event system models, availability graph. Dynamic analysis of discrete-event systems: constraint, availability analysis, dead ends. Model-based generation and verification of discrete control sequences. Direct and prediction diagnostics based on discrete-event system models. Generalization of discrete-event system models to describe different classes of hybrid systems.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The subject knowledge provides high-level theoretical knowledge to PhD students intending to delve into transport science to solve modeling, dynamic analysis, diagnostic, and control tasks in transport systems that can be described as discrete events.

18. Requirements, way to determine a grade (obtain a signature)

An individual task for modeling and dynamic analysis of a simple discrete event transport system. The prerequisite for obtaining the signature and for passing the exam is the complete and timely submission of the individual student assignment. The exam is oral.

19. Retake and delayed completion

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20. Learning materials

C. G. Cassandras, S. Lafortune: Introduction to Discrete Event Systems. Springer, 2008.
Lakner R., Hangos K., Gerzson M.: Intelligens irányító rendszerek. Tzpotex Kiadó, Bp. 2011. pp. 1.-87.

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

Subject description

1. Subject name	**Drive techniques PhD**				
2. Subject name in Hungarian	Hajtástechnika PhD			**3. Role**	Specific course
4. Code	**BMEKOGED006**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	42 hours	**Preparation for seminars**	7 hours	**Homework**	20 hours
Reading written materials	7 hours	**Midterm preparation**	0 hours	**Exam preparation**	14 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Basics of drive technics. Driving and driven torque curves. Drives with internal combustion engines. Type and task of clutches. Structure of mechanical gearboxes. Driving and driven inertias. Shifting mechanism. Process of gear changing. Types and shiftability of synchronizers. Shiftability of spline clutches. Gearbox design regarding manufacturing and shiftability. Bearings and lubrication in gearboxes. Robotized and double clutch gearboxes, design and problems. Hybrid vehicle layouts.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- Problems and solutions in driveline technics.

b) Ability:
- Design of a driveline with internal combustion engine.

c) Attitude:
- Being open to understand and learn novelties on that given domain.

d) Autonomy and responsibility:
- Evaluation and choice of elements for an optimal solution.

18. Requirements, way to determine a grade (obtain a signature)

Semester note upon succesful realisation of the homework and an oral exam.

19. Retake and delayed completion

Secondary deadline for the homework precised in the lessons requirements.

20. Learning materials

-

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

Subject description

1. Subject name	**Electronic control of aircraft engines PhD**				
2. Subject name in Hungarian	Repülőgép hajtóművek elektronikus szabályozása PhD			**3. Role**	Specific course
4. Code	**BMEKOVRD001**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**1 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	42 hours	**Preparation for seminars**	14 hours	**Homework**	28 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	28 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Beneda Károly
12. Lecturers	Dr. Beneda Károly

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Objectives and methods of theoretical introductory mathematical modeling, considering the possibilities of modern nonlinear modeling, eg. neural network. Connecting the mathematical model and the subject of control: possibilities and methods of identification. Summary of the application of classical control theory in the design of control systems for gas turbine engines. Possibilities offered by modern control theory: state space representation from uniaxial gas turbine to tri-axial bypass jet engines. Design of control system with state feedback using linear quadratic and H∞ methods. Application of Loop Transfer Recovery method for gas turbines. Theoretical background and implementations of model-based adaptive controls, with particular reference to multi-input, multi-output systems (eg variable geometry jet drive). Stochastic and Markov modeling of bypass jet engines. General description of the mbed microcontroller development system and its application in the rapid prototype development of gear control systems.

15. Description of practices

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16. Description of laboratory practices

Measurements on gas turbine engines, testing of control algorithms

17. Learning outcomes

a) Knowledge:
- The student is familiar with the theoretical background of electronic control systems for advanced gas turbine aircraft engines, current industry control solutions, and LQR, LQG / LTR, adaptive model-based controls.

b) Ability:
- The student is able to investigate the operating characteristics of different engines on a theoretical level by performing simulations. Able to perform identification and control measurements to test control algorithms. The student is able to design, develop and achieve new industrial and scientific results after analyzing and evaluating the obtained test data.

c) Attitude:
- The student aims to complete his/her studies at the highest level, under the shortest time, by providing his/her knowledge and capacity at the best to obtain knowledge for deep and independent professional work; The student has strong professional commitment, has developed expectations for finding new, better solutions and has agreement on doing hard work.

d) Autonomy and responsibility:
- The student takes responsibility for guiding mates by the quality of his/her work and by keeping ethic norms. The student takes responsibility for applying the knowledge in line with the studied conditions, limitations and constraints. The student can friendly accept the well-established constructive criticism and can utilize that in future. The student is a creative constructor, proactive, and has leadership skills and argument techniques, capabilities with responsibility during the studies, research work.

18. Requirements, way to determine a grade (obtain a signature)

The criterion of the acceptance of the semester and so getting the signature is the completeness of the solution of a defined problem in a specific area in the agreed time and quality. The exam is oral. The final mark of the exam is the mathematical average of the results for the own task and the exam.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

G. G. Kulikov, H. A. Thompson: Dynamic Modeling of Gas Turbines. Identification, Simulation, Condition Monitoring and Optimal Control. Springer, London, 2004. ISBN 1852337842
H. Richter: Advanced Control of Turbofan Engines. Springer, New York, 2011. ISBN 978-1-4614-1170-3
A. Linke-Diesinger: Systems of Commercial Turbofan Engines. Springer, Berlin, 2008. ISBN 978-3-540-73618-9
E. Lavretsky, K. A. Wise: Robust and Adaptive Control – with aerospace applications. Springer, London, 2013. ISBN 978-1-4471-4396-3

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

Subject description

1. Subject name	**Electronically controlled vehicle systems PhD**				
2. Subject name in Hungarian	Elektronikusan szabályozott járműrendszerek PhD			**3. Role**	Basic course
4. Code	**BMEKOGJD003**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	22 hours
Reading written materials	26 hours	**Midterm preparation**	30 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Tihanyi Viktor
12. Lecturers	Dr. Tihanyi Viktor

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Our students can effectively use the knowledge of this subjects during their research on modern, electronically controlled vehicle dynamics systems. Topics: design problem of electronically controlled vehicle dynamics systems used in modern vehicles; different types of suspension control systems; electronically controlled levelling systems of commercial vehicles; electronically controlled steering, braking and driving systems; stablility control system.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:
- Familiar with vehicle dynamics fundamnetals.

b) Ability:
- Ability to research and develop specific processes.

c) Attitude:
- Openness to new opportunities in the field.

d) Autonomy and responsibility:
- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

The acquisition of the signature of the subject, and, in addition, the condition of taking exam is giving in the complete individual student homework for deadline. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Hans Pacejka: Tire and Vehicle Dynamics, Elsevier B-ELS-049, ISBN of 9780080970172, 2012.
Tire and Wheel Technology, 2011, SAE International SP-2296, ISBN of 978-0-7680-4735-6, 2011.
Vehicle Dynamics Stability and Control, 2011, SAE International SP-2297, ISBN of 978-0-7680-4736-3, 2011.
Rao V. Dukkipati, Jian Pang, Mohamad S. Qatu, Gang Sheng, Zuo Shuguang, Road Vehicle Dynamics, SAE International, R-366, ISBN of 978-0-7680-1643-7, 2008.

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

Subject description

1. Subject name	**Environmental effects of transport**				
2. Subject name in Hungarian	Közlekedési rendszerek környezeti hatásai			**3. Role**	Specific course
4. Code	**BMEKOKUD020**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**88 hours**
Contact hours	56 hours	**Preparation for seminars**	5 hours	**Homework**	6 hours
Reading written materials	8 hours	**Midterm preparation**	5 hours	**Exam preparation**	8 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Mészáros Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Transport- environment, factors of environmental impact, the problem of sustainability. Mitigation of environmental impacts of transport, regulations, policies, tendencies, practices. Local and international case studies. EIA, decision making, preparation of decisions on the field of transport infrastructure development. Integration of transport and land use policies. Environmental conflicts of freight transport, intermodality and transit policies. Environmental costs of transport, the case of externalities, prices and charges. Urban transport, opportunities of sustainable urban environmental management, integration of environmentally sound mobility forms. Sustainable Urban Mobility Plans. Demand management, parking and road charges. Requirements of fuel efficiency, alternative fuels, energy efficient and environmentally enhanced vehicles.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student gets acquainted with the environmental factors of the environment, its impact processes, the problem of sustainability. It will be able to identify, quantify and mitigate the environmental impacts of transport. Learn about the direction of regulations, policies, and trends. With the help of domestic and international examples, case studies open their minds.

18. Requirements, way to determine a grade (obtain a signature)

It is required to fulfill in time the individual student work.

19. Retake and delayed completion

The attendance requirements cannot be delayed completed. The individual case study report can be delayed submitted in the delayed completion period.

20. Learning materials

YOSHITSUGU HAYASHI, JOHN ROY: Transport, Land-Use and the Environment - Springer

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

Subject description

1. Subject name	**Experimental Modal Analysis I.**				
2. Subject name in Hungarian	Kísérleti modálelemzés I.			**3. Role**	Specific course
4. Code	**BMEKOEAD016**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**1 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	42 hours	**Preparation for seminars**	0 hours	**Homework**	6 hours
Reading written materials	6 hours	**Midterm preparation**	0 hours	**Exam preparation**	6 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Pápai Ferenc
12. Lecturers	Dr. Pápai Ferenc

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Basics of complex algebra. Parameters and errors of signal choice. 1 DOF system behavior in time and frequency domain. Frequency function measurement. Parameter estimation. Matrix operations, basics of matrix functions. Regression methods. Caracteristics of multi DOF systems. Natural value, natural vector. Oscillations in damped and not damped case. Relationship between material caracteritics and damping. Excited vibrations.

15. Description of practices

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16. Description of laboratory practices

Measurements on parts and small assemblies, as learnt on the lessons.

17. Learning outcomes

a) Knowledge:
- Basics of modal analysis theory. Basics of measurement technics.

b) Ability:
- Measurement and parameter identification of parts and simple structures.

c) Attitude:
- Being open to understand and learn novelties on that given domain.

d) Autonomy and responsibility:
- Evaluation and choice of elements for an optimal solution.

18. Requirements, way to determine a grade (obtain a signature)

Semester note upon succesful realisation of the homeworks, realisation of the measurement reports, and a written exam.

19. Retake and delayed completion

Homework and measurement report secondary deadlines precised in the lessons requirements.

20. Learning materials

-

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

Subject description

1. Subject name	**Experimental Modal Analysis II.**				
2. Subject name in Hungarian	Kísérleti modálelemzés II.			**3. Role**	Specific course
4. Code	**BMEKOEAD017**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**1 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	42 hours	**Preparation for seminars**	0 hours	**Homework**	6 hours
Reading written materials	6 hours	**Midterm preparation**	0 hours	**Exam preparation**	6 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Pápai Ferenc
12. Lecturers	Dr. Pápai Ferenc

13. Prerequisites	Experimental Modal Analysis I. (BMEKOEAD016), strong; - (-), -; - (-), -

14. Description of lectures

Global model building methods in space. Estimation of non viscous damping parameter. Output-only methods. Study of sensitivity. Parameter estimation in time domain. Modifications in structure dynamics. Structure synthesis. Validation of Finite element models. Excitation methods, tools. Structure diagnostics and its applications. Seismic behavior of a structure. Analyse of large sized structures.

15. Description of practices

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16. Description of laboratory practices

Measurements on parts and small assemblies, as learnt on the lessons.

17. Learning outcomes

a) Knowledge:
- Deep knowledge of modal analysis.

b) Ability:
- Measurement and parameter identification of complex structures. Measurement in time domain. Validation of parameters.

c) Attitude:
- Being open to understand and learn novelties on that given domain.

d) Autonomy and responsibility:
- Evaluation and choice of elements for an optimal solution.

18. Requirements, way to determine a grade (obtain a signature)

Semester note upon succesful realisation of the homeworks, realisation of the measurement reports, and a written exam.

19. Retake and delayed completion

Homework and measurement report secondary deadlines precised in the lessons requirements.

20. Learning materials

-

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

Subject description

1. Subject name	**Financing Transport Infrastructure**				
2. Subject name in Hungarian	Financing Transport Infrastructure			**3. Role**	Basic course
4. Code	**BMEKOKKD007**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	8 hours	**Homework**	14 hours
Reading written materials	28 hours	**Midterm preparation**	4 hours	**Exam preparation**	10 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Békefi Zoltán
12. Lecturers	Dr. Békefi Zoltán

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The student is able to independently develop innovative solutions for the cost of using transport. It is capable of critically analyzing new research results in the field of fees, flexibility, and time saving. It is able to interpret PPP structures independently in the context of the project, and is able to distinguish the characteristics of different funding structures in a structured way. It is capable of structured risk analysis.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- The student becomes familiar with the significant financial and economical aspects of the development projects in transportation and logistics.

b) Ability:

- The student can evaluate and increase the financial-economical efficiency of projects.

c) Attitude:

- The student strives for the integrated handling of the technical, economical, social, financial and environmental aspects of transportation projects.

d) Autonomy and responsibility:

- The student is able to make independent analyzis and evaluation activities.

18. Requirements, way to determine a grade (obtain a signature)

Preparing and presenting the presentation, participation on the lectures and computer labs.

19. Retake and delayed completion

The written homework and presentation can be delayed till end of delayed completion period.

20. Learning materials

European Strategies: White paper 2011; Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system
European Commission, Directorate General Regional Policy, Guide to Cost-Benefit Analysis of investment projects.
References used for the presentations prepared by the students

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

Subject description

1. Subject name	**Flight Safety, PhD**				
2. Subject name in Hungarian	Repülésbiztonság PhD			**3. Role**	Specific course
4. Code	**BMEKORHD017**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	15 hours
Reading written materials	15 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The subject gives a brief overview of the aviation system, its most important elements. Then he deals with opportunities for improvement of aviation safety, interpretation of safety, indicators of aviation safety, risk, flight situations, their classification, risk management, development of methods of risk analysis, regularities of reliability models.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: the basics of the safety of the prepulse, the indicators of flight safety, the flight situations and their classification, the methods of risk management and risk analysis.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Accepted homework and oral exam.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Shari Krause: Aircraft Safety (ISBN-10: 0071409742)
James M. Walters: Aircraft Accident analysis (ISBN-10: 0071351493)
Richard H. Wood: Aviation Safety Programs: A Management Handbook (ISBN-10: 0884873293)
Clarence rodrigues: Commercial Aviation Safety (ISBN-10: 0071763058)

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

Subject description

1. Subject name	**Functionalanalysis for Engineers**				
2. Subject name in Hungarian	Funkcionálanalízis mérnököknek			**3. Role**	Basic course
4. Code	**BMEKOVJD018**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	0 hours
Reading written materials	30 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Zobory István
12. Lecturers	Dr. Zobory István

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Linear normed spaces, operators and functionals on linear spaces. Operations among operators. Metric spaces. The Baire-theorem. Semi-norm. Compactness. Continuity of linear operators. Contraction operators. Complementary concepts. The geometry of Hilbert-spaces. Complete ortonormal systems. The Gram-Schmidt ortogonalization. The projection theorem. The ortogonal complementer. Direct-sum of Hilbert spaces. The representation theorem of Frigyes Riesz. The dual space of a linear space. Unitary and izometric operators. Fourier transform, Fourier operator. The Hahn-Banach theorem. Application of functional analysis in the numerical methods. The Ritz-process.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: theory of linear functionals and operators; application of the functional analysis in numerical methods.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Regular participation at the lectures and written exam.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Zobory I.: Funkcionálanalízis mérnököknek. Egyetemi jegyzet. Vasúti Járművek Tanszék, Budapest, 2007.
Máté László: Funkcionálanalízis műszakiaknak. Műszaki Könyvkiadó. Budapest, 1976.
Reddy, J.N.: Applied Functional Analysis and Variational Methods in Engineering. Krieger Publishing Company, Malabar, Florida, 1991.
Mikolás M.: Valós függvénytan és ortogonális sorok. Tankönykiadó, Budapest, 1978

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

Subject description

1. Subject name	**Informatics in Logistics (PhD)**				
2. Subject name in Hungarian	Logisztikai informatika (PhD)			**3. Role**	Basic course
4. Code	**BMEKOKUD014**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	7 hours	**Homework**	37 hours
Reading written materials	20 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Kovács Gábor
12. Lecturers	Dr. Kovács Gábor

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The subject gives advanced knowledge of information technology in logistics systems, including modelling and enterprise resource planning systems. One of the main aim is to help the own research of PhD students, which is connected with logistics information systems.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Knowledge of the modular structure and operation of the logistics information systems.
- Knowledge of related optimum search tasks and solutions.

b) Ability:

- Able to study the logistics information systems, taking into account the scientific requirements.
- Able to carry out research and development tasks related to the logistics information systems.

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The grade of the PhD student is based on the semester activity and the evaluation of the paper (publishing), in consultation with the supervisor.

19. Retake and delayed completion

Announced at the beginning of the semester.

20. Learning materials

Slides and examples in electronic format.

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

Subject description

1. Subject name	**Innovative methods for the demand planning**				
2. Subject name in Hungarian	A kereslettervezés korszerű módszerei			**3. Role**	Specific course
4. Code	**BMEKOALD003**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	42 hours	**Preparation for seminars**	7 hours	**Homework**	30 hours
Reading written materials	11 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Operational Research in Logistics (BMEKOALD001), recommended; - (-), -; - (-), -

14. Description of lectures

Innovative techniques and approaches in the denamd planning. Segmentation of the demand planning process. Data mining, clearing and filtering. Aggregation methodes, the role of the baseline. New approach in the model identification. Model selection techniques. Multi-criteria optimization techniques in the parameterizing of the forecasting models. Disaggregation methodes, fine tuning of the forecasting models. Measurement problems in the demand planning, the forecast error and accuraccy. Application of artificial intelligence in the demand planning. Harmonizing of corporate planning tasks, the role of the S&OP process.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Knowledge of the tasks and problems of the demand planning.
- Knowledge of the mathematical modelling techniques.
- Knowledge of the related optimum searching and statistical data mining tasks and solutions.

b) Ability:

- Able to study the demand planning tasks, taking into account the scientific requirements.
- Able to carry out research and development tasks related to the demand planning.

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The grade of the PhD student is based on the research activity, and the quality of the developed model, and the scientific white paper.

19. Retake and delayed completion

Announced at the beginning of the semester.

20. Learning materials

C. Chatfield: The Analysis of Time Series, Chapman & Hall/CRC, 2004
Armstrong, J. Scott (ed.): Principles of forecasting: a handbook for researchers and practitioners (in English). Norwell, Massachusetts: Kluwer Academic Publishers. ISBN 0-7923-7930-6., 2001
Makridakis, Spyros; Wheelwright, Steven; Hyndman, Rob J.: Forecasting: methods and applications (in English). New York: John Wiley & Sons. ISBN 0-471-53233-9., 1998
http://www.neural-forecasting.com/

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

Subject description

1. Subject name	**Innovative methods for the inventory planning**				
2. Subject name in Hungarian	A készlettervezés korszerű módszerei			**3. Role**	Specific course
4. Code	**BMEKOALD008**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	42 hours	**Preparation for seminars**	7 hours	**Homework**	30 hours
Reading written materials	11 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Operational Research in Logistics (BMEKOALD001), recommended; - (-), -; - (-), -

14. Description of lectures

Innovative techniques and approaches in the inventory planning. Purchasing order scheduling problems, and special issues of the inventory theory. Multi-criteria optimization problems in inventory processes. Inventory control. Simulation modelling of inventory processes, and its applications in the inventory control. Application of artificial intelligence in the inventory planning. The specialities of the inventory networks, inventory routing problems. Inventory planning in case of dependent demand, developement directions of MRP systems. Inventory planning problems in case of reverse logistics networks. Harmonizing of corporate planning tasks, the role of the S&OP process.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Knowledge of the tasks and problems of the inventory planning.
- Knowledge of the mathematical modelling techniques.
- Knowledge of the related optimum searching and statistical data mining tasks and solutions.

b) Ability:

- Able to study the inventory planning tasks, taking into account the scientific requirements.
- Able to carry out research and development tasks related to the inventory planning.

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The grade of the PhD student is based on the research activity, and the quality of the developed model, and the scientific white paper.
Announced at the beginning of the semester.

19. Retake and delayed completion

Announced at the beginning of the semester.

20. Learning materials

Waters, D.: Inventory Control and Management, John Wiley & Sons, 2007
Axsäter, S.: Inventory Control, Springer, 2006
Bartmann, D., Beckmann, M. J.: Inventory control: models and methods, Springer, 1992
Love, S. F.: Inventory control, McGraw-Hill, 1979

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

Subject description

1. Subject name	**Intelligent and autonomous vehicle control system**				
2. Subject name in Hungarian	Intelligens és autonóm járműirányítási rendszerek			**3. Role**	Basic course
4. Code	**BMEKOKAD019**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	10 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	42 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Németh Balázs
12. Lecturers	Dr. Németh Balázs

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Hierechy in the vehicle control systems. Robust, LPV and MPC vehicle control design methods. Predictive cruise control systems. Interactions of autonomous and human-driven vehicles. Autonomous vehicle control in various traffic scenarios. Machine learning techniques and autonomous vehicles.

15. Description of practices

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16. Description of laboratory practices

-

17. Learning outcomes

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18. Requirements, way to determine a grade (obtain a signature)

Final exam and homework.

19. Retake and delayed completion

-

20. Learning materials

-

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

Subject description

1. Subject name	**Intelligent vehicle-road systems PhD**				
2. Subject name in Hungarian	Intelligens jármű-út renszerek PhD			**3. Role**	Specific course
4. Code	**BMEKOGJD005**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	22 hours
Reading written materials	26 hours	**Midterm preparation**	30 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Tihanyi Viktor
12. Lecturers	Dr. Tihanyi Viktor

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Our students can effectively use the knowledge of this subjects during their research on intelligent vehicle / highway systems, driver assist systems. The course discusses the design of the systems mounted on vehicle and on its surrounding, the simulation of transportation systems.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:
- Familiar with vehicle dynamics fundamnetals.

b) Ability:
- Ability to research and develop specific processes.

c) Attitude:
- Openness to new opportunities in the field.

d) Autonomy and responsibility:
- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

The acquisition of the signature of the subject, and, in addition, the condition of taking exam is giving in the complete individual student homework for deadline. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Hans Pacejka: Tire and Vehicle Dynamics, Elsevier B-ELS-049, ISBN of 9780080970172, 2012.
Tire and Wheel Technology, 2011, SAE International SP-2296, ISBN of 978-0-7680-4735-6, 2011.
Vehicle Dynamics Stability and Control, 2011, SAE International SP-2297, ISBN of 978-0-7680-4736-3, 2011.
Rao V. Dukkipati, Jian Pang, Mohamad S. Qatu, Gang Sheng, Zuo Shuguang, Road Vehicle Dynamics, SAE International, R-366, ISBN of 978-0-7680-1643-7, 2008.

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

Subject description

1. Subject name	**Joining Technologies in Vehicle Industry**				
2. Subject name in Hungarian	Járműipari kötéstechnológiák			**3. Role**	Specific course
4. Code	**BMEKOGTD015**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**34 hours**
Contact hours	10 hours	**Preparation for seminars**	0 hours	**Homework**	10 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	4 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Markovits Tamás
12. Lecturers	Dr. Markovits Tamás

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Knowing and analyzing system components and processes of joining technologies used in the automotive industry. Parts connections particularly used in the automotive industry. Joining technologies for sheet materials. Joining by plastic deformation. Welding (spot welding, projection welding, stud welding), brazing by various methods. Adhesive bonding. Screw connections. Process control solutions for joining processes.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:
- Familiar with modern automotive joining technologies and the internal realtions of some specific processes.

b) Ability:
- Ability to research and develop specific processes.

c) Attitude:
- Openness to new opportunities in the field.

d) Autonomy and responsibility:
- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

It is necessary to prepare and submit an independent homework within the subject. The course ends with an oral exam.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

1. Kalpak J.: Manufacturing Engineering and Technology, Prentice Hall, 2013.

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

Subject description

1. Subject name	**Laser Technology**				
2. Subject name in Hungarian	Lézertechnológiák			**3. Role**	Specific course
4. Code	**BMEKOGTD003**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**44 hours**
Contact hours	10 hours	**Preparation for seminars**	0 hours	**Homework**	20 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	4 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Markovits Tamás
12. Lecturers	Dr. Markovits Tamás

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Operation of lasers. The main characteristics of the laser beam, the methods of beam guiding and beam shaping. The interaction between material and laser beam. Construction of laser sources. Measuring the power and modus. Laser technologies: laser cutting, welding, drilling technology, surface treatment, marking. Adaptive control of lasers. Integration of lasers into production. Laser safety.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Familiar with modern laser technologies and the internal realtions of some specific processes.

b) Ability:

- Ability to research and develop specific processes.

c) Attitud:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

It is necessary to prepare and submit an independent homework within the subject. The course ends with an oral exam.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Steen W., Mazumder J.: Laser Material Processing, Springer, 2010.

1. Tárgy neve	**Machine Vision PhD**				
2. Tárgy angol neve	Gépi látás PhD			**3. Szerep**	Basic course
4. Tárgykód	**KOALD009**	**5. Követelmény**	**m**	**6. Kredit**	**5**
7. Óraszám (levelező)	**2 (28) lecture**	**0 (0) practice**	**2 (28) lab**	**8. Tanterv**	**D**

9. A tantárgy elvégzéséhez szükséges tanulmányi munkaóra összesen					**150 hours**
Kontakt óra	56 hours	**Órára készülés**	16 hours	**Házi feladat**	50 hours
Írásos tananyag	18 hours	**Zárthelyire készülés**	10 hours	**Vizsgafelkészülés**	0 hours

10. Felelős tanszék	Department of Material Handling and Logistics Systems
11. Felelős oktató	Dr. Szirányi Tamás
12. Oktatók	Dr. Szirányi Tamás, Rózsa Zoltán

13. Előtanulmány	Képfeldolgozás; (BMEKOALD002); ajánlott

14. Előadás tematikája

Machine vision is the most important measure of intelligent road transport. Allows you to track the complex movement and traffic participants, continuously analyze situations and locations. The processing and semantic evaluation of the video stream extracted through the camera gives basic information to the autonomous driving. The subject is about capturing, analyzing and interpreting visual information: extracting high-level image descriptors from lower-level visual characteristics.

1. Machine vision in the society of autonomous robots (e.g. autonomous driving): technology, devices, system requirements, software tools and environment; overview of main tasks and related mathematical and algorithmic background; summary of basic image processing methods applied in the following.
2. Shape representation and description (regions, active contours, shape description, region decomposition, superpixel); definitions of shapes in 2D, 3D and 3D point-clouds.
3. Scale Space axioms of image understanding (Lindeberg's edge/ridge definition: multiscale segmentation and sceletonization, SIFT and similar feature detectors, anisotropic diffusion, RANSAC fitting)
4. Energy optimization based image analysis (Markov Random Field, simulated annealing, region segmentation) for remote sensing and change detection; MRF as preprocessing in motion segmentation and active layer in Deep Convolutional Neural Nets.
5. Deconvolution: Wiener filter, iteration based deconvolution, and Bayesian-based Lucy-Richardson blind-deconvolution, super-resolution.
6. Video processing and analysis; Background/ foreground/ Shadow segmentation (mixture of Gaussian models, shadow models, foreground fitting); Motion Analysis (Optical flow, interest point detection and tracking, video tracking);
7. Pattern recognition in 2D and 3D (Statistical-, Neural-, Syntactic- pattern recognition, graph based comparison); Principal Component Analysis; Kernel Methods;
8. Biometrical personal identification for human-computer interactions: face-, hand-, finger-, and gesture-recognition; camera-based eye-tracking and saliency definitions, attention detection in short;
9. Image- and video-features; Generating and using annotated data sets: training-, test-and validation-sets. Content based image- and video-analysis, -indexing and –retrieval; the curse of dimensionality;
10. Reconstruction of the scanned environment from monocular and multiple-view vision; Image based Simultaneous Localization and Mapping (I-SLAM) for automatic driving localization.
11. Multimodal/multiview fusion: fusion of sensors and cameras of different positions and spectra: optical-, infra- and depth-cameras. Motion tracking in multiple-view; Traffic surveillance and control from street cameras and on-board moving devices.
12. Hidden Markov Models: speech and motion based recognition; pedestrian- and vehicle- detection and tracking; event detection: behaviour of the surrounding pedestrians and vehicles.
13. Deep learning structures for image based driving assistance: Recurrent neural networks; Ways to make neural networks generalize better. Combining multiple neural networks to improve generalization. Learning issues.
14. Novel pattern recognition structures: Convolutional Neural Networks, Hopfield nets, Boltzmann machines, Deep Neural Networks with generative pre-training. Modeling hierarchical structures with neural nets. Examples: pedestrian detection and vehicle analysis.
15. Demonstration of the participants' project development during the semester.

15. Gyakorlat tematikája

-

16. Labor tematikája

Computer exercises; MATLAB programming.

17. Tanulási eredmények

a) Knowledge:

- Knows advanced image processing algorithms.
- Knows three-dimensional shape recognition methods.
- Is familiar with environmental reconstruction technologies.
- Is familiar with modern, neural network-based approaches to image processing.

b) Ability:

- Design of image object and shape recognition algorithm.
- Can see the architectural issues of a machine vision system.

- Is able to select a suitable tool and algorithm for a given task.

c) Attitude:

- Open to learn about modern vision systems.
- Open to automatic use of machine vision in vehicle control.

d) Autonomy and responsibility:

- Can participate in image processing projects independently or in a team.
- Is able to design a vision system that meets the given task and safety requirements.

18. Követelmények, az osztályzat (aláírás) kialakításának módja

Two midsemester exam and an individual homework. The final grade is the average of the two midterm exam.

19. Pótlási lehetőségek

One Midterm exam and the homework can be retried.

20. Jegyzet, tankönyv, felhasználható irodalom

Lecture notes.

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

Subject description

1. Subject name	**Management methods in transportation**				
2. Subject name in Hungarian	Menedzsment módszerek a közlekedésben			**3. Role**	Specific course
4. Code	**BMEKOKKD004**	**5. Evaluation type**	**m**	**6. Credits**	**3**
7. Weekly contact hours	**0 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	30 hours
Reading written materials	14 hours	**Midterm preparation**	4 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Kővári Botond
12. Lecturers	Dr. Kővári Botond

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Trends in the relationship between market shapes and modes of transport. Novel solutions for exploring demand-supply relationships. Predicting domestic and international traffic trends. Innovative development of transport company management processes. Critical analysis of companies' cost / revenue relationships

15. Description of practices

Literature research in a topic discussed with the lecturer, and write and present a seminar paper.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:
- Familiar with economic issues of a company and its marketing activities.

b) Ability:
- Ability to overview a company in an economic way, to evaluate the market position.

c) Attitude:
- Strive to acquire the highest level of system approach.

d) Autonomy and responsibility:
- Responsible applies of acquired knowledge in individual or in team work.

18. Requirements, way to determine a grade (obtain a signature)

1 test, 1 shorter homework.

19. Retake and delayed completion

Second test possibility for those not present on the test, possibility of delayed deadline for home work.

20. Learning materials

Suggested books and papers.

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

Subject description

1. Subject name	**Materials Science**				
2. Subject name in Hungarian	Anyagtudomány			**3. Role**	Basic course
4. Code	**BMEKOGGD001**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**84 hours**
Contact hours	56 hours	**Preparation for seminars**	0 hours	**Homework**	8 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	12 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Bán Krisztián
12. Lecturers	Dr. Bán Krisztián

13. Prerequisites	Advanced materials and technologies (BMEKOGGM601), recommended; - (-), -; - (-), -

14. Description of lectures

Material structures: bonding types, materials with crystalline and amorphous structure. Thermodynamics, diffusion, phase transitions. Non-equilibrium systems and thermodynamics: amorphous and nanostructured materials and their properties. The role of surface in material properties. Material properties: effect of different bonding types, defect structure (real structure) on transport, optical, magnetic and mechanical properties. Material testing: procedures for polycrystalline materials: X-ray diffraction, texture test. SEM, DSC, TEM as test methods. Metallographic examinations, microscopic properties of structural materials, examination of grain structure. Spectroscopy. Mechanical (tensile, micro- and macro-hardness, impact energy) test methods and equipments, non-destructive testing methods for material defects. Special material testing methods.

15. Description of practices

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16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Recognizes new regularities in the types of chemical bonds. It recognizes new laws of crystalline and amorphous structure.
- It recognizes new regularities in the field of thermodynamics. It recognizes new laws of diffusion.
- It recognizes new regularities about the thermodynamic background, types, energetic relations of phase transitions, and the importance of the interface in phase transitions. Recognizes new regularities about types of non-equilibrium systems.
- It recognizes new regularities about the role of the interface in material properties.
- Recognizes new regularities in the properties of amorphous and nanostructured materials.
- Recognizes new regularities about the effects of different bonds, error structures (real structures) in transport, optical, magnetic and mechanical properties. Recognizes new regularities with major direct structural analysis methods: XRD, texture, SEM, TEM, optical microscopy. It recognizes new regularities in major spectroscopic examination procedures.
- Recognizes new laws regarding the DSC test method.
- Recognizes new laws through the application of major mechanical and non-destructive material testing methods.

b) Ability:

- It is capable of understanding the entire process and its elements, or of a process. plan.
- It is capable of deeper, causal, scientific analysis of a technological or measurement process.
- Can formulate suggestions for the development of a technological or measurement process.
- He / she is able to collect literature on a specific research topic for a focus question and to compile a summary based on it.
- They are able to interpret the results found in the literature.
- He / she is able to design experimental designs and research methods on a research topic. Able to interpret test results.

c) Attitude:

- It strives to develop its knowledge independently. It strives to ensure that each topic area and / or theme. look for relationships between disciplines. It seeks to share its knowledge.
- It seeks to ensure that the literature and literature. interpret your own research results individually and in teamwork, listening to the thoughts of others.

d) Autonomy and responsibility:

- Responsibly apply the knowledge gained in the subject subject to its limitations. It manages according to ethical standards and communicates the results to others and itself. It seeks to carry out the task entrusted to it independently, in accordance with ethical standards. You are aware of the extent to which your responsibilities extend to informing your colleagues or supervisors of the results and if needed.

18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

Charles Kittel: Introduction to solid state physics,
Thornton, Calangelo: Fundamentals of engineering materials, Prentice-Hall, Inc. New Jersey, 1985,
Flinn, Trojan: Engineering Materials and Their Applications,
Kalpakijan S.: Manufacturing Engineering and Technology, Prentice Hall, 2013.
Auxiliary materials and ppt's downloadable from the department website.

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

Subject description

1. Subject name	**Mathematical methods I.**				
2. Subject name in Hungarian	Matematikai módszerek I.			**3. Role**	Basic course
4. Code	**BMEKOKAD003**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	20 hours	**Homework**	10 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	24 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Péter Tamás
12. Lecturers	Dr. Péter Tamás

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

1.) Extreme value theorem.
2.) Regression analysis. The basic equation of regression. Ritz method. Regression surface. Multidimensional regression. Scalar vector function. Regression of vector-vector function. Complex function regression. Implicit function regression. Regression of a Parameter Assigned Function. Regression of the space curve Special Regression Procedures. Statistical linearization method. SISO and MIMO models. Harmonic linearization. Inverse linearization.
3.) Calculus of variations. Functional concept. Subject of the variation calculation. The "Brachisztochron problem". The Ritz method. The Lemma of variation calculation. The Euler-Lagrange equation. The variational method in mechanics.
4.) The equation of motion, in mathematical physics. The variation principle in mechanics. The Hamilton's principle. Applications for dynamic systems. Lagrange equations. Fermat's principle in geometrical optics.
5.) Theory of Linear Systems. Zadeh's definition of the system. Abstract objects. Equivalence of two or more objects. Convolution, convolution batch. Weight function batch, SISO and MIMO systems. Transmission matrix and weight function matrix..
6.) The Stochastic processes. Definition. Classification. Categories. The multivariate distribution.
The Stationarity. Determining the expected value of the process and its autocorrelation function.
The ergodic processes. Auto and cross correlation function Definition of auto and cross spectrum Properties. SISO and MIMO systems. The definition of spectral density. Definition and relationship of spectra. Calculation of spectral density.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

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18. Requirements, way to determine a grade (obtain a signature)

The credits are obtained by completing the assignment and by passing the oral exam.

19. Retake and delayed completion

-

20. Learning materials

-

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

Subject description

1. Subject name	**Mathematical methods II.**				
2. Subject name in Hungarian	Matematikai módszerek II.			**3. Role**	Basic course
4. Code	**BMEKOKAD007**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**1 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	28 hours	**Homework**	12 hours
Reading written materials	16 hours	**Midterm preparation**	20 hours	**Exam preparation**	16 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Péter Tamás
12. Lecturers	Dr. Péter Tamás

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

1.) The symbolic calculations. Definition of Computer algebra. Key features of symbolic calculations. The limitations of symbolic calculations. Symbolic and numerical calculations. Mathematical analysis in Maple environment. Graphic applications.
2.) Modeling of transport systems. Vehicle dynamics modeling. Mathematical modeling of spatial non-linear swing system. Modeling of road transport systems. Modeling large-scale networks. Automating mathematical modeling for large complex systems.
3.) The notable equations and their applications. Euler equation. Euler-Lagrange equation. The Lagrange's equations of the first kind. The Lagrange's equations of the second kind.
1.) 4.) Designing Optimum Linear Systems. To solve the Riccati equation by Anderson's iteration method. Kalman-Bucy filter by Maple.Design of nonlinear systems. Maple Analysis of Lyapunov Functions

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

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18. Requirements, way to determine a grade (obtain a signature)

The credits are obtained by completing the assignment and by passing the oral exam.

19. Retake and delayed completion

-

20. Learning materials

-

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

Subject description

1. Subject name	**Measurement technologies of heat engines I.**				
2. Subject name in Hungarian	Hőerőgépek méréstechnikája I.			**3. Role**	Specific course
4. Code	**BMEKOGJD011**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**2 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	14 hours	**Preparation for seminars**	14 hours	**Homework**	12 hours
Reading written materials	20 hours	**Midterm preparation**	30 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Zöldy Máté
12. Lecturers	Dr. Zöldy Máté

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Objective of the subject is the description of laboratory test of heat-engines, especially the internal combustion engine, its propellant and lubricants.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Is familiar with the images presented in the subject and the individual procedures of the internal relationships.

b) Ability:

- Capable of all procedures and research.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- A vehicle for solving research tasks.

18. Requirements, way to determine a grade (obtain a signature)

Knowing the curriculum and application of it. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Martyr, Plint: Engine Testing (The Design, Building, Modification and Use of Powertrain Test Facilites). 4. edition, Elsevier 2012.
Kuratle: Motorenmesstechnik. Vogel Buchverlag, 1995.

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

Subject description

1. Subject name	**Measurement technologies of heat engines II.**				
2. Subject name in Hungarian	Hőerőgépek méréstechnikája II			**3. Role**	Specific course
4. Code	**BMEKOGJD014**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**2 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	14 hours	**Preparation for seminars**	14 hours	**Homework**	12 hours
Reading written materials	20 hours	**Midterm preparation**	30 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Zöldy Máté
12. Lecturers	Dr. Zöldy Máté

13. Prerequisites	Measurement technologies of heat engines I. (BMEKOGJD011), strong; - (-), -; - (-), -

14. Description of lectures

Objective of the subject is the description of laboratory test of heat-engines, especially the internal combustion engine, its propellant and lubricants. (continuation of Measurement technologies of heat engines I.)

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Is familiar with the images presented in the subject and the individual procedures of the internal relationships.

b) Ability:

- Capable of all procedures and research.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- A vehicle for solving research tasks.

18. Requirements, way to determine a grade (obtain a signature)

Knowing the curriculum and application of it. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Martyr, Plint: Engine Testing (The Design, Building, Modification and Use of Powertrain Test Facilites). 4. edition, Elsevier 2012.
Kuratle: Motorenmesstechnik. Vogel Buchverlag, 1995.

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

Subject description

1. Subject name	**Mechanics of plastic deformations**				
2. Subject name in Hungarian	Képlékeny alakváltozások mechanikája			**3. Role**	Basic course
4. Code	**BMEKOJSD002**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**1 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	42 hours	**Preparation for seminars**	12 hours	**Homework**	28 hours
Reading written materials	14 hours	**Midterm preparation**	0 hours	**Exam preparation**	24 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Béda Péter
12. Lecturers	Dr. Béda Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Notion of the plastic body. Plasticity conditions: Tresca - Saint-Venant, Mises. The elasto-plastic deformation theory: Hencky's equations. Plastic flow theory: Prandtl-Reuss equations. Various models of the plastic hardening. Basic equations of the theory of plasticity. Incremental forms of the material equations. Applications: pulled, bent and torsioned rod; elasto-plastic deformation of a thick walled tube, discharging, remanent stress; plastic planar flow, sliding lines. Plastic stability.

15. Description of practices

Examples from the topics of the lessons.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- Methods of the theory of plasticity.

b) Ability:
- Description of the plastic material behaviour, model building.

c) Attitude:
- Being open to understand and learn novelties on that given domain.

d) Autonomy and responsibility:
- Evaluation and choice of optimal model elements.

18. Requirements, way to determine a grade (obtain a signature)

Semester note upon succesful realisation of the homework and an oral exam.

19. Retake and delayed completion

Essay secondary deadlines precised in the lessons requirements.

20. Learning materials

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

Subject description

1. Subject name	**Modern 3D Design PhD**				
2. Subject name in Hungarian	Korszerű 3D ábrázolás PhD			**3. Role**	Specific course
4. Code	**BMEKOJSD006**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**0 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	10 hours	**Homework**	62 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	20 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Ficzere Péter
12. Lecturers	Dr. Ficzere Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Types and description of CAD systems. Demonstration of applications and role of 3D engineering modeling software in machine design. Modeling of prismatic bodies, preparation of patterns. Modeling of revolved bodies. Creating 3D cuts, adding subtitle labels, callouts, managing output formats. Examination of physical properties, determination of center of volume and mass. Determination of the areas of the surfaces. Create assemblies, constraining of the parts. Fit investigation, exploded views, motion simulation. Renderings. Generation of drafts (views, cuts, etc.), item numbers, parts list. Lofted and swept protrusions and cuts. Basics of the finite element analysis (linear static structural, normal modes, buckling, steady state heat transfer). Shape optimisation. Generative design. Documentation

15. Description of practices

Exercising theoretical knowledge with examples and case studies.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Knowledge of modeling, simulation and testing capabilities provided by 3D design software.
- Knows the conditions for interoperability between CAD models.
- He understands the basic conditions of finite element analysis and can define the necessary conditions. He can define the conditions, variables, target functions needed for shape optimization.

b) Ability:

- Able to create a 3D model of any complex part. Able to receive and modify any 3D model made in another CAD system.
- Able to perform physical examinations of the designed parts (determination of the center of volume and mass. Determination of the area of the surfaces).
- Able to assemble parts and to constranin to function properly.
- Able to test and control assemblies (Fit investigation, exploded view, motion simulation).
- Able to produce proper 3D documentation (use of 3D sections, labels, pointing lines, colors) and assembly instructions. Able to create drawings and videos of structures.
- Able to create rendered, realistic graphs and place them in their real environment (virtual reality). Able to produce high quality marketing materials.
- Able to generate the necessary views, sections with the help of the prepared solid models. Able to produce correct technical drawings according to standard rules.
- Able to create a 3D solid model based on 2D drawings.
- Able to produce formats required for CAM software.
- Able to make finite element analysis on part sor on complex structures, assemblies. Able to define the needed constraints, loads, boundary conditions. Able to evaluate the results and to document them at the appropriate level.
- Able to perform shape optimization using finite element simulation results. Able to define the constraints, thresholds, design variables, convergence criteria and target function required for the optimisation process.
- Able to implement generative design in practice.

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

It is required to fulfill in time the individual student work.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

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

Subject description

1. Subject name	**Modern control theory II.**				
2. Subject name in Hungarian	Modern irányitáselmélet II			**3. Role**	Basic course
4. Code	**BMEKOKAD002**	**5. Evaluation type**	**e**	**6. Credits**	**5**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**56 hours**
Contact hours	56 hours	**Preparation for seminars**	0 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Bokor József
12. Lecturers	Dr. Bokor József, Dr. Szabó Zoltán

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

This course provides an introduction to robust control theory. Starting from basics, i.e., signal and system norms, stability, stabilizability and performance measures we develop first the classical LQ theory, followed by the H2 design. We emphasise the role of the small gain approach in the robust analysis and synthesis. The main part of the course is dedicated to the Hinfinity design, both the two Riccati and the LMI approach. Finally the structured singular value with mu analysis and synthesis is presented.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

18. Requirements, way to determine a grade (obtain a signature)

The credits are obtained by completing the design task and by passing the oral exam. Prior to be accepted for the exam, students should fulfil the design task and should summarize their results in a report.

19. Retake and delayed completion

-

20. Learning materials

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

Subject description

1. Subject name	**Nonlinear control**				
2. Subject name in Hungarian	Nemlineáris irányítások			**3. Role**	Basic course
4. Code	**BMEKOKAD018**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**42 hours**
Contact hours	42 hours	**Preparation for seminars**	hours	**Homework**	hours
Reading written materials	hours	**Midterm preparation**	hours	**Exam preparation**	hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Szabó Zoltán
12. Lecturers	Dr. Szabó Zoltán

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

This course provides an initialization in nonlinear control theory. We introduce the basic concepts related to the geometric approach to nonlinear geometric system theory based on invariant distributions and provide solutions for the most fundamental design problems. As an illustration switched systems are presented. Linearization techniques are presented. It follows Lyapunov based stability theory, passivity based approaches and backstepping design. We provide some methods for nonlinear observer design. The courde ends with gain scheduling and LPV techniques.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

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18. Requirements, way to determine a grade (obtain a signature)

a) Knowledge and Ability:

- The credits are obtained by completing the design task and by passing the oral exam. Prior to be accepted for the exam, students should fulfil the design task and should summarize their results in a report.

19. Retake and delayed completion

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20. Learning materials

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

Subject description

1. Subject name	**Nonlinear mechanical oscillations**				
2. Subject name in Hungarian	Nemlineáris mechanikai lengések			**3. Role**	Basic course
4. Code	**BMEKOJSD003**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**1 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	42 hours	**Preparation for seminars**	12 hours	**Homework**	28 hours
Reading written materials	14 hours	**Midterm preparation**	0 hours	**Exam preparation**	24 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Béda Péter
12. Lecturers	Dr. Béda Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Equilibrium of a mechanical system, stability of the equilibrium (definitions, stability and instability conditions). Stability of motions. Notion and construction of the Lyapunov function. Lyapunov~s direct and indirect method, the Routh-Hurwitz criterion. Nonlinear stability theory, notion of the bifurcation, soft and hard loss of stability. Reduction methods: central multitude method, Lyapunov-Schmidt reduction. Bifurcation equations, numerical methods of the bifurcation theory.

15. Description of practices

Examples from the topics of the lessons.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- Methods of the nonlinear mechanics.

b) Ability:
- Description of a nonlinear mechanical system behaviour, model building.

c) Attitude:
- Being open to understand and learn novelties on that given domain.

d) Autonomy and responsibility:
- Evaluation and choice of optimal model elements.

18. Requirements, way to determine a grade (obtain a signature)

Semester note upon succesful realisation of the homework and an oral exam.

19. Retake and delayed completion

Essay secondary deadlines precised in the lessons requirements.

20. Learning materials

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

Subject description

1. Subject name	**Numerical Methods for Fluid Flows I.**				
2. Subject name in Hungarian	Numerikus módszerek az áramlástanban I.			**3. Role**	Specific course
4. Code	**BMEKORHD006**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**28 hours**
Contact hours	28 hours	**Preparation for seminars**	hours	**Homework**	hours
Reading written materials	hours	**Midterm preparation**	hours	**Exam preparation**	hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Veress Árpád
12. Lecturers	Dr. Veress Árpád

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Introduction to numerical methods for fluid flows.Mathematical models of flow physics and approaches for considering the dynamic level of approximations.Mathematical nature of flow equations and their boundary conditions.Basic discretization techniques (finite difference, finite volume and finite element methods).Numerical meshes and their properties.Numerical schemes their characteristics and investigation methods (consistency, stability and convergence). High resolution numerical schemes, Time integration methods for space-discretized equations, Iterative methods for the resolution of algebraic systems. Applications for inviscid and viscous flow. (book by Hirsch I.)

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- The student knows the governing equations of the numerical methods for fluid flows, the most widespread discretization methods, their characteristics, the relevant numerical schemes and algorithms and their mathematical analysis in the state of the art manner;

b) Ability:
- The student can perform and/or develop numerical discretization of the governing equations according to the requirements and the mathematical analysis of numerical schemes and algorithms resulted by the numerical discretization.

c) Attitude:
- The student aims to complete his/her studies at the highest level, under the shortest time, by providing his/her knowledge and capacity at the best to obtain knowledge for deep and independent professional work. The student has strong professional commitment, has developed expectations for finding new, better solutions and has agreement on doing hard work.

d) Autonomy and responsibility:
- The student takes responsibility for guiding mates by the quality of his/her work and by keeping ethic norms. The student takes responsibility for applying the knowledge in line with the studied conditions, limitations and constraints. The student can friendly accept the well-established constructive criticism and can utilize that in future. The student is a creative constructor, proactive, and has leadership skills and argument techniques, capabilities with responsibility during the studies, research work.

18. Requirements, way to determine a grade (obtain a signature)

The criterion of the acceptance of the semester and so getting the signature is the completeness of the solution of a defined problem in a specific area in the agreed time and quality. The exam is oral. The final mark of the exam is the mathematical average of the results for the own task and the exam.

19. Retake and delayed completion

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20. Learning materials

The presentation about the lectures, simulation guide lines and tutorials provided by the professor,
Hirsch, Charles: Numerical Computation of Internal and External Flows, Volume 1 and 2, ISBN-10: 0471923850, ISBN-13: 978-0471923855, John Wiley and Sons (2001),
Veress, Á.: Introduction to CFD, BME, Department of Aeronautics, Naval Architecture and Railway Vehicles, Lecture notes, (2002),
ANSYS, Inc., ANSYS CFX-Solver Theory Guide, Release 2019 R1, ANSYS, Inc. Southpointe, 2600 ANSYS Derive Canonsburg, PA15317, ansysinfo@ansys.com, http://www.ansys.com, USA, 2019.

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

Subject description

1. Subject name	**Numerical Methods for Fluid Flows II.**				
2. Subject name in Hungarian	Numerikus módszerek az áramlástanban II.			**3. Role**	Specific course
4. Code	**BMEKORHD002**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**28 hours**
Contact hours	28 hours	**Preparation for seminars**	hours	**Homework**	hours
Reading written materials	hours	**Midterm preparation**	hours	**Exam preparation**	hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Veress Árpád
12. Lecturers	Dr. Veress Árpád

13. Prerequisites	Numerical Methods for Fluid Flows I. (KORHD006), strong; - (-), -; - (-), -

14. Description of lectures

Introduction to CFD (Computational Fluid Dynamics) via scientific and industrial applications, Numerical solution of the system of the Euler equations, Numerical solution of the system of the Navier-Stokes equations. (book by Hirsch II.)

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- The student knows the different forms of the system of the Euler and Navier-Stokes equations, their numerical solutions and the developments of the Euler equations based inverse design method.

b) Ability:

- The student can perform and develop numerical discretizations and solutions of the Euler and Navier-Stokes equations. The student can complete Euler equation based inverse design method.

c) Attitude:

- The student aims to complete his/her studies at the highest level, under the shortest time, by providing his/her knowledge and capacity at the best to obtain knowledge for deep and independent professional work. The student has strong professional commitment, has developed expectations for finding new, better solutions and has agreement on doing hard work.

d) Autonomy and responsibility:

- The student takes responsibility for guiding mates by the quality of his/her work and by keeping ethic norms. The student takes responsibility for applying the knowledge in line with the studied conditions, limitations and constraints. The student can friendly accept the well-established constructive criticism and can utilize that in future. The student is a creative constructor, proactive, and has leadership skills and argument techniques, capabilities with responsibility during the studies, research work.

18. Requirements, way to determine a grade (obtain a signature)

The criterion of the acceptance of the semester and so getting the signature is the completeness of the solution of a defined problem in a specific area in the agreed time and quality. The exam is oral. The final mark of the exam is the mathematical average of the results for the own task and the exam.

19. Retake and delayed completion

-

20. Learning materials

The presentation about the lectures, simulation guide lines and tutorials provided by the professor,
Hirsch, Charles: Numerical Computation of Internal and External Flows, Volume 1 and 2, ISBN-10: 0471923850, ISBN-13: 978-0471923855, John Wiley and Sons (2001),
Veress, Á.: Introduction to CFD, BME, Department of Aeronautics, Naval Architecture and Railway Vehicles, Lecture notes, (2002),
ANSYS, Inc., ANSYS CFX-Solver Theory Guide, Release 2019 R1, ANSYS, Inc. Southpointe, 2600 ANSYS Derive Canonsburg, PA15317, ansysinfo@ansys.com, http://www.ansys.com, USA, 2019.
Veress, Á. and Rohács, J.: Application of Finite Volume Method in Fluid Dynamics and Inverse Design Based Optimization, DOI: 10.5772/38786, ISBN 978-953-51-0445-2 (2012)
http://www.intechopen.com/books/finite-volume-method-powerful-means-of-engineering-design/application-of-finite-volume-method-in-fluid-dynamics-and-inverse-design-based-optimization

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

Subject description

1. Subject name	**Operation of construction machines**				
2. Subject name in Hungarian	Építőgépek üzeme			**3. Role**	Specific course
4. Code	**BMEKOEAD004**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**48 hours**
Contact hours	28 hours	**Preparation for seminars**	4 hours	**Homework**	8 hours
Reading written materials	4 hours	**Midterm preparation**	4 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bohács Gábor
12. Lecturers	Dr. Bohács Gábor

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The subject aims to survey the advanced construction machine systems and their components. Related optimization problems are presented as well. First specific machines and processes are surveyed. Further possibilities for automation is discussed. These include not only hardware devices but the necessary software as well. The subjects deals with construction machines as system components, where supervision and control is an important issue. During the semester two tests are written and an individual students essay is developed.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Modern construction processes and automation possibilities.
- Software to support modern construction engineering.
- System engineering characteristics of construction engineering.

b) Ability:

- Ability to develop construction engineering system and process concepts.
- Ability to optimize construction engineering systems..

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The grade is calculated from the grade of the individual work and the tests as an average.

19. Retake and delayed completion

Announced at the beginning of the semester.

20. Learning materials

Mahesh Varma: Construction equipment and its planning and application

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

Subject description

1. Subject name	**Operational Research in Logistics**				
2. Subject name in Hungarian	Operációkutatás a logisztikában			**3. Role**	Basic course
4. Code	**BMEKOALD001**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	7 hours	**Homework**	37 hours
Reading written materials	20 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The specialities of the logistics modeling. The typical properties of the logistics optimization problems. Deterministic and stochastic dynamic programing in logistics. Multi-criteria optimization problems and models, analitical hierarchy process and pareto optimizing in logistics systems. Linear and non-linear programing and conditional optimum searching in logistics. Stochastic modeling, optimum seeking in stochastic environment. Mathematical algorithms of the discrate event based simulation models, and its applications in logistics system modelling. Special issues in operational research. Soft computing techniques based optimum seeking in logistics modeling. Documentation of logistics models and algorithms (case study).

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Knowledge of the logistics oriented operational research problems.
- Knowledge of the mathematical modelling tools.
- Knowledge of the related journals and literatures to analyse the state of the art.

b) Ability:

- Able to study the operational researching problems, taking into account the scientific requirements.
- Able to create and design mathematical models related to the real problems and effects.

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The grade of the Phd student is based on the research activity, and the quality of the developed model, and the scientific white paper.

19. Retake and delayed completion

Announced at the beginning of the semester.

20. Learning materials

Wayne L. Winston: Operations Research: Applications and Algorithms, 4th Edition, Cengage Learning, 2003.
Frederick S. Hillier, Gerald J. Lieberman: Introduction To Operations Research 10th Edition, Mc Graw Hill India; 10th edition, 2017.
Operational research related e-books and websites

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

Subject description

1. Subject name	**Optimal Control**				
2. Subject name in Hungarian	Optimális Irányítások			**3. Role**	
4. Code		**5. Evaluation type**	**e**	**6. Credits**	
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	

9. Working hours for fulfilling the requirements of the subject					**75 hours**
Contact hours	28 hours	**Preparation for seminars**	5 hours	**Homework**	20 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	14 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Tamás Luspay, PhD
12. Lecturers	Tamás Luspay, PhD

13. Prerequisites	(), ; (), ; (),

14. Description of lectures

The course covers the theory of optimal control with practical engineering applications. During the course several different approaches will be discussed for computing optimal solutions for various control problems. We will emphasize the connection between these approaches and also give an outlook on how the principles can be applied for other engineering problems. Our aim is to present this essential topic with accurate mathematical tools and from a practical engineering viewpoint. Therefore, simple numerical examples and MATLAB exercises are included to illustrate the application of the theory. The students will be assigned a special home work, which has to be solved by combining analytic and numerical methods and accordingly it will develop a systematic approach for solving problems.

1, Introduction to system theory, basic notions. The problem of optimal control.
2, Static optimization, Lagrange method. Calculus of variation.
3, Calculus of variation and optimal control.
4, Pontrjagins maximum principle and the transversality condition.
5, Dynamic programming, the principle of optimality.
6, Hamilton Jacobi Bellman equations.
7, Linear quadratic problems.
8, Infinite horizon problems and their connection with stability.
9, Approximate dynamic programming. Bellman equation. Value iteration, policy iteration.
10, Numerical methods.
11, Optimal control and the receding horizon principle.
12, Dynamic programming and machine learning.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- The notion of optimality and optimal control.
- Different approaches for determining a solution in an engineering process, where quality or quantity requirements are important
- Open- and closed-loop optimal control methods.

b) Ability:
- Able to formulate an engineering management task mathematically.
- Able to set up criterion functions knowing the system and the process.
- Able to design and implement optimal controls.

c) Attitude:
- Thinking on a system level.
- Problemsolver and constructive.

d) Independence and responsibility:
- Analyzing the behaviour of an engineering system, based on its qualitative and quantitative parameters.
- Setting up criterias for engineering processes.
- Decisison making regarding the methodologies for controlling engineering systems.

18. Requirements, way to determine a grade (obtain a signature)

During the semester an individiual home work is assigned to each student, which are related to the interest, research field of the student.

At the end of the semester students make their presentation about their work.

The requirements for obtaining the signature is: presence at least 70% of the lectures and the successfull accomplishment of the home work.

At the end of the semester there will be an oral exam.

Grades are determined based on the result of the exam and home work.

19. Opportunity for repeat/retake and delayed completion

The home work can be complement during the exam period.

20. Learning materials

D. Bertsekas: Dynamic Programming and Optimal Control, Vols I-II, Athena Scientific (IV edition 2017)
D. Bertsekas: Reinforcment Learning and Optimal Control, Athena Scientific, 2019
M. Athans: Optimal Control: An Introduction to the Theory and Its Applications, Dover Books on Engineering, 2006
D. Kirk: Optimal Control Theory: An Introduction, Dover Books on Electrical Engineering, 2004
H. Kwakernaak and R. Sivan: Linear Optimal Control Systems, Wiley, 1972
R. Stengel: Optimal Control and Estimation, Dover Books on Mathematics, 1994

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

Subject description

1. Subject name	**Packaging Technologies**				
2. Subject name in Hungarian	Csomagolástechnika			**3. Role**	Specific course
4. Code	**BMEKOALD005**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	42 hours	**Preparation for seminars**	7 hours	**Homework**	30 hours
Reading written materials	11 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Kovács Gábor
12. Lecturers	Dr. Kovács Gábor

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The optimization process of unit load (pallet, container, intermodal units e.g.) creation. Computerized packaging design. Optimization of the used packaging materials. The automatized unit-load creation. The used packaging and unit load optimization algorithm.

15. Description of practices

-

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Knowledge of the tasks and problems of the packaging design.
- Knowledge of related optimum search tasks and solutions.

b) Ability:

- Able to study the packaging design tasks, taking into account the scientific requirements.
- Able to carry out research and development tasks related to the packaging technology.

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The grade of the PhD student is based on the semester activity and the evaluation of the paper (publishing), in consultation with the supervisor.

19. Retake and delayed completion

Announced at the beginning of the semester.

20. Learning materials

Slides and examples in electronic format

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

Subject description

1. Subject name	**Passenger Transport Systems (PhD)**				
2. Subject name in Hungarian	Személyközlekedési rendszerek (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKUD021**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	56 hours	**Preparation for seminars**	15 hours	**Homework**	34 hours
Reading written materials	20 hours	**Midterm preparation**	15 hours	**Exam preparation**	10 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Csiszár Csaba
12. Lecturers	Dr. Csiszár Csaba, Csonka Bálint, Földes Dávid

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

General characterization of passenger transportation system. Classification of transportation modes – features, travel chains. Quality of passenger transportation services. Planning of parking, pedestrian and bicycle traffic. Car-sharing systems. Ride-sharing systems. Chauffeur services. Taxi service, ride-sourcing. Planning of public transport services. Operation of electric buses in public transportation.

15. Description of practices

Learn and practice the measurement, analysis and planning methods. Case studies. Independ-ent literature research supported by consultations. Student presentations. The students elaborate four (individually and/or in teamwork) assignments. The task should be presented.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The students know structure and operation of passenger transportation systems.
- They are able to analyse and design passenger transportation systems and operational processes.
- The students strive for precise and errorless task accomplishment.

b) Attitude, Autonomy and responsibility:

- They apply the knowledge with responsibility.
- They are able to work independently or in a team according to the situation.

18. Requirements, way to determine a grade (obtain a signature)

The students write 2 midterms (with theoretical and practical parts). The mid-semester signature is obtained if both midterms are passed (at least half of the maximal scores) and all four student assignments are submitted and accepted (at least half of the maximal scores). The semester is finished by oral exam.

19. Retake and delayed completion

The midterms can be retaken according to TVSZ (study code). The student assignments can be submitted after deadline (if extra fee is paid).

20. Learning materials

ppt slides, Csaba Csiszár – Bálint Csonka – Dávid Földes: Innovative Passenger Transportation Systems (book) (2019)

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

Subject description

1. Subject name	**Planning of Transport Databases (PhD)**				
2. Subject name in Hungarian	Közlekedési adatbázisok tervezése (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKUD004**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**0 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	28 hours	**Preparation for seminars**	0 hours	**Homework**	20 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	4 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Juhász János
12. Lecturers	Dr. Juhász János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The aim of the course is to learn how to capture, store, collect and analyse traffic-related data, to get to know, choose and apply the most common methods:

- Methods of collecting and storing traffic data. Sources of error.
- Questionnaire data collection forms, ways of storing and processing data, transport applications.
- Description of data model types, presentation of their usage possibilities.
- Structure, characteristics and comparison of OLAP, MOLAP, ROLAP, OLTP systems.
- Big Data's theoretical background, overview of transport examples.
- Characteristics and methods of analysis of GIS databases. Traffic location identification systems.
- The system of registration, construction, information content of road accidents involved injured persons.

15. Description of practices

Exercising theoretical knowledge with examples and case studies.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Knows the methods of collecting traffic data. Knows the different data model types.
- Knows the structure, characteristics and peculiarities of OLAP, MOLAP, ROLAP, and OLTP systems.
- Knows the Big Data's theoretical background. Knows the structure and main characteristics of GIS systems.
- Knows the structure of the road accident database.

b) Ability:

- Able to design and execute data collection. Able to design and build a data storage structure.
- Able to select the most suitable data model type for the purpose.
- Able to design and prepare a geospatial database, to map data, to create spatial queries.
- Able to retrieve information from a personal road accident database.

c) Attitude:

- The student attends the lectures, prepare independent study on time.
- During the lectures, he is actively involved in processing the current topic.
- During the independent study the student strives to develop new technical solutions.
- Interested in international and domestic developments in the field. Open to learn new knowledge and learn.

d) Autonomy and responsibility:

- Apply responsibility the knowledge acquired in the course of the course. Can independently develop new technical solutions.
- Accepts the framework of collaboration, can perform its work independently or as part of a team, depending on the task.

18. Requirements, way to determine a grade (obtain a signature)

Exam. Evaluation of individual study.

19. Retake and delayed completion

Retake exam. Study repair.

20. Learning materials

Supported by downloadable documents from the Department website.

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

Subject description

1. Subject name	**Processes of Vehicle Production**				
2. Subject name in Hungarian	Járműgyártás és javítás			**3. Role**	Basic course
4. Code	**BMEKOGGD003**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**84 hours**
Contact hours	56 hours	**Preparation for seminars**	0 hours	**Homework**	8 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	12 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Markovits Tamás
12. Lecturers	Dr. Markovits Tamás

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Sequence of manufacturing processes, its impact on quality, productivity and costs. Sequence planning (pre-products, allowance for machining); operation planning (bases); operation instruction (operation time). Tolerances for different manufacturing technologies. Measurement technology: measurement methods, regularities of measurement errors, typical measurement tasks and their instruments, coordinate measurements. Machines for vehicle manufacturing technologies.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:
- Has a deeper understanding of how the succession of technological processes affects quality, productivity and costs.
- Knows the purpose and steps of the technological sequence design (pre-products, allowance for machining); operation planning (bases); operation instruction (operation time).
- Knows what tolerances have been expected for different manufacturing technologies.
- Familiar with measurement methods, regularities of measurement errors, typical measurement tasks and tools, coordinate measurements. Knows the most important machines of vehicle manufacturing technologies.

b) Ability:
- Able to overview the whole and the elements of a technological process and to plan it especially for technology design and quality control. Capable of a deeper, causal, scientific analysis of a technological process.
- Able to give suggestions for the development of a technological process.
- She/he is able to gather literature on a specific research topic and compile a summary based on it.
- Able to interpret the results found in the literature. Able to develop a suitable experimental method for a research topic and propose test methods. Able to interpret test results.

c) Attitude:
- She/he strives to develop his knowledge independently. Strives to explore the causal relationship with scientific depth.
- Strives to develop its own topic area. Strives to find connections between topics and disciplines.
- Strives to interpret the literature and their own research results independently and in teamwork, listening to others' thoughts.
- Strives to share her/his knowledge.
- Independence and responsibility:

d) Autonomy and responsibility:
- Apply responsibly the knowledge acquired during the course with regard to their validity limits.
- Manages and communicates the results of others and their own results also in accordance with ethical standards.
- Endeavors to perform his assigned tasks independently in accordance with ethical standards. She/he knows how far his responsibilities are, informs his colleagues or his supervisor about her/his results, and when it is necessary.

18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

Kalpakijan S.: Manufacturing Engineering and Technology, Prentice Hall, 2013.
Flinn R. A., Trojan P. K.: Engineering Materials and Their Applications, Houghton Mifflin Co International Inc., 1989.

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

Subject description

1. Subject name	**Processes of Vehicle Production**				
2. Subject name in Hungarian	Járműgyártás folyamatai			**3. Role**	Basic course
4. Code	**BMEKOGTD013**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**84 hours**
Contact hours	56 hours	**Preparation for seminars**	0 hours	**Homework**	8 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	12 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Vehovszky Balázs
12. Lecturers	Dr. Vehovszky Balázs

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The student is able to critically evaluate the development trends in the production technology of typical vehicle parts, main units and some of their components. Developing plasticization technologies in the engine, chassis, bodywork; cold and heat shaping, to explore novel regularities that are inherent to the characteristics of each technological process. Vehicle parts pre-fabrication technologies: innovative development of casting, precision, die-casting, volume, sheet forming, hydroforming, sheet cutting (mechanical, thermal, water jet), bonding technologies (welding, soldering, riveting, gluing). Developing process design for machining technologies, developing specific tools (lathes, drills, milling, hollow, tapping, toothing, grinding)

15. Description of practices

-

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Has a deeper knowledge of the characteristics of cold and hot forming technology. Familiar with the technologies of plastic forming used in motor, chassis and bodywork production. Has a deeper knowledge of casting technologies: sand molding, shell molding, die-casting, precision (lost-vax) casting, pressure casting. Has a deeper knowledge of sheet metal forming technologies: conventional and hydroforming, sheet cutting (mechanical, thermal, water jet). Knows the bonding technologies used in the automotive industry: welding, soldering, riveting, adhesive bonding. Has a deeper knowledge of process engineering, cutting-edge tools (turning, drill, milling, broaching, thread machining, gear cutting, grinding) of cutting technologies, about their selection, their renewal and the basics of their design. Knows the methods of tool management.

b) Ability:

- Able to overview the whole and the elements of a technological process and to plan it. Capable of a deeper, causal, scientific analysis of a technological process. Able to give suggestions for the development of a technological process. She/he is able to gather literature on a specific research topic and compile a summary based on it. Able to interpret the results found in the literature. Able to develop a suitable experimental method for a research topic and propose test methods. Able to interpret test results.

c) Attitude:

- She/he strives to develop his knowledge independently. Strives to explore the causal relationship with scientific depth. Strives to develop its own topic area. Strives to find connections between topics and disciplines. Strives to interpret the literature and their own research results independently and in teamwork, listening to others' thoughts. Strives to share her/his knowledge.

d) Autonomy and responsibility:

- Apply responsibly the knowledge acquired during the course with regard to their validity limits. Manages and communicates the results of others and their own results also in accordance with ethical standards. Endeavors to perform his assigned tasks independently in accordance with ethical standards. She/he knows how far his responsibilities are, informs his colleagues or his supervisor about her/his results, and when it is necessary.

18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

Kalpakijan S.: Manufacturing Engineering and Technology, Prentice Hall, 2013
Flinn R. A., Trojan P. K.: Engineering Materials and Their Applications, Houghton Mifflin Co International Inc., 1989.

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

Subject description

1. Subject name	**R&I process management in the industry**				
2. Subject name in Hungarian	Ipari K+F folyamatok menedzsmentje			**3. Role**	Specific course
4. Code	**BMEKOGGD804**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	14 hours	**Preparation for seminars**	18 hours	**Homework**	5 hours
Reading written materials	5 hours	**Midterm preparation**	18 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Zöldy Máté
12. Lecturers	Dr. Zöldy Máté

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Self-assessment and expected evolution of industrial R&D processes. Planning, monitoring, conducting and developing integrated R & D & I processes in an industrial environment. Preparation of research and development project proposal. Critical understanding of the activities of competing market players and the outcome of the R&D process. Process monitoring and asset development.

15. Description of practices

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16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Is familiar with the images presented in the subject and the individual procedures of the internal relationships.

b) Ability:

- Capable of all procedures and research.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- A vehicle for solving research tasks.

18. Requirements, way to determine a grade (obtain a signature)

Knowing the curriculum and application of it. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

The Innovation Tools Handbook, Volume 1: Organizational and Operational Tools, Methods, and Techniques that Every Innovator Must Know

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

Subject description

1. Subject name	**Railway technology**				
2. Subject name in Hungarian	Vasúti üzemtan (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKKD010**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for seminars**	6 hours	**Homework**	24 hours
Reading written materials	6 hours	**Midterm preparation**	16 hours	**Exam preparation**	10 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Mándoki Péter
12. Lecturers	Dr. Mándoki Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The role of railway stations in railway opertaion. Specific properties of railway infrastructure and vehicles. Shedule planning of passenger and freight transport. Organizing of rail transport, intermodality connection. Description of flat shunting technologies. Shunting yards. Creating a stationary work plan. Control of train traffic in different train transport technologies. Shedule planning. Planning of engine, trains and cres turns.

15. Description of practices

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16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- The student knows the characteristics and planning techniques of railway operation.

b) Ability:

- Ability to dealing with creative problems in the field of transport and flexible solutions to complex tasks. Able to plan the railway opertaion (stations and lines). Able to working in a group, sharing tasks and managing them over time.

c) Attitude:

- engages in professional and ethical values related to the technical field, and works based on a system-oriented and process-oriented mindset, in a team-work.

d) Autonomy and responsibility:

- Make his decisions carefully, in consultation with representatives of other fields of expertise, with full responsibility.

18. Requirements, way to determine a grade (obtain a signature)

Defendse of semester task and oral examination.

19. Retake and delayed completion

Unsuccessful task can be replaced during the replacement period.

20. Learning materials

Uploaded materials to theMoodle System and the Department website.

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

Subject description

1. Subject name	**Rapid Prototyping**				
2. Subject name in Hungarian	Gyors prototípusgyártás			**3. Role**	Specific course
4. Code	**BMEKOGTD004**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**44 hours**
Contact hours	10 hours	**Preparation for seminars**	0 hours	**Homework**	20 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	4 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Takács János
12. Lecturers	Dr. Takács János, Dr. Markovits Tamás

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The position of Rapid Prototyping (RP) in product design and production. Relationship between product development, modeling and simulation. Comparison of traditional and parallel design, real and virtual prototypes. Physical implementation of models. Rapid manufacturing (RM).

Rapid prototyping techniques: lamoinated Object oModeling (LOM), Fused Deposition Modelling (FDM), Stereolithography (SLA), Selective Laser Sintering and Melting (SLS, SLM), Laser Material Deposition (LMD). Accuracy, productivity, cost, technical characteristics of procedures.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Familiar with additive technologies and the internal realtions of a specific processes.

b) Ability:

- Ability to research and develop specific processes.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

It is necessary to prepare and submit an independent homework within the subject. The course ends with an oral exam.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Chua C. K., Leong K. F., Lim C. S.,: Rapid Prototyping: Principles and Applications, World Scientific Publishing Co. Pte. Ltd., 2010.
Kamrani A. K., Abouel N. E.: Rapid Prototyping, Springer, 2006.

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

Subject description

1. Subject name	**Reaction processes of internal combustion engines**				
2. Subject name in Hungarian	Belsőégésű motorok reakciófolyamatai.			**3. Role**	Basic course
4. Code	**BMEKOGJD013**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	22 hours	**Homework**	50 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	20 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Zöldy Máté
12. Lecturers	Dr. Zöldy Máté

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Description of combustion and reaction kinetic processes taking place in internal combustion engines. For PhD students dealing with related research topics to combustion, effect of fuels and pollution formation in internal combustion engines.

15. Description of practices

-

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Is familiar with the images presented in the subject and the individual procedures of the internal relationships.

b) Ability:

- Capable of all procedures and research.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- A vehicle for solving research tasks.

18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Warnatz, Maas, Dibble: Combustion, Springer, 2006

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

Subject description

1. Subject name	**Reinforcement Learning for vehicle control**				
2. Subject name in Hungarian	Megerősítéses tanulás a járműirányításban			**3. Role**	Specific course
4. Code	**BMEKOKAD017**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	30 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	18 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Bécsi Tamás
12. Lecturers	Dr Bécsi Tamás, Dr. Aradi Szilárd

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Problem solving, placement in machine learning. Heuristics, dynamic and static heuristics. Effectiveness and complexity of algorithms. Curse of dimensions. The Markov decision model, the hidden Markov decision model. Traceability problem. Classic solutions for self-learning systems, case study for routing algorithms. Fundamentals of neural networks, supervised teaching, general network structures. Discrete, continuous and regular tasks. Reverse learning, Imitation learning. Demonstrator and demonstration, policy, loss function and algorithms. Value based learning, Q-learning. The exploration-exploitation dilemma. Variations of Q learning, Deep Q, DQN. Behavior based learning algorithms, Policy gradients, deterministic, and stochastic policy.

15. Description of practices

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16. Description of laboratory practices

-

17. Learning outcomes

-

18. Requirements, way to determine a grade (obtain a signature)

Final exam and three homeworks.

19. Retake and delayed completion

-

20. Learning materials

-

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

Subject description

1. Subject name	**Research techniques**				
2. Subject name in Hungarian	Kutatási alapismeretek			**3. Role**	Specific course
4. Code	**BMEKOKAD004**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**56 hours**
Contact hours	28 hours	**Preparation for seminars**	0 hours	**Homework**	28 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Tettamanti Tamás, Dr. Török Ádám
12. Lecturers	Dr. Tettamanti Tamás, Dr. Török Ádám

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Management of publication databases. Critical Understanding of IF, SNIP and Novel Publication Performance Meters. Application of innovative reference systems, understanding and critical interpretation of plagiarism. Learning the basics of Zotero, LateX. Review of the theoretical basics of article writing, its independent application. Basics of writing a dissertation.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student interprets and manages the link organizing, editing and word processing software required for writing articles.
- It is able to briefly summarize its novel scientific results in the form of an article.
- He is committed and critical to the development of communication technologies in the technical and economic field.
- Solve problems in a creative way.
- By applying domestic and international databases, your thinking becomes more open and your knowledge is constantly updated.

18. Requirements, way to determine a grade (obtain a signature)

Completed homeworks and semester projekt.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

-

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

Subject description

1. Subject name	**Risk and safety integrity in traffic**				
2. Subject name in Hungarian	Kockázat és biztonságintegritás a közlekedésben			**3. Role**	Specific course
4. Code	**BMEKOKAD008**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**42 hours**
Contact hours	42 hours	**Preparation for seminars**	0 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Sághi Balázs
12. Lecturers	Dr. Sághi Balázs

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The aim of the subject is to provide students with special knowledge in risk analysis and assessment and safety integrity in different fields of transportation.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

18. Requirements, way to determine a grade (obtain a signature)

Final mark is given based on the result of the exam (50%) and ont he prepared study (50%).

19. Retake and delayed completion

-

20. Learning materials

-

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

Subject description

1. Subject name	**Road Telematic Systems**				
2. Subject name in Hungarian	Közúti telematikai rendszerek PhD			**3. Role**	Specific course
4. Code	**BMEKOKUD023**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**1 lecture**	**1 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for seminars**	4 hours	**Homework**	30 hours
Reading written materials	10 hours	**Midterm preparation**	8 hours	**Exam preparation**	10 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Defioniton of telematics and traffic management. The goals and classification of information and traffic influencing systems. The elements of intelligent transport systems. The application of satellite based communication in transportation. ITS on highways and in city transport. Information systems in private and public transport. Parking management in cities. Electronic data interchange (EDI) in transport.

15. Description of practices

Analysis and development of telematics systems in a choosen city.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Familiar with types and features of road telematic systems, the relevant terms and standards.

b) Ability:

- Ability to classify road telematic systems. Able to elaborate the developments concepts of existing road telematic systems.

c) Attitude:

- Strive to acquire the highest level of system approach.

d) Autonomy and responsibility:

- Responsible applies of acquired knowledge in individual or in team work.

18. Requirements, way to determine a grade (obtain a signature)

The criterion of the signature (and to take the exam) is to solve the chosen project till the deadline and to write the midterm exam at least an acceptable level. The exam is written.

19. Retake and delayed completion

Second test possibility for those not present on the test, possibility of delayed deadline for home work.

20. Learning materials

-

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

Subject description

1. Subject name	**Road traffic modelling, simulation and control**				
2. Subject name in Hungarian	Közúti járműforgalom modellezése, szimulációja és irányítása			**3. Role**	Basic course
4. Code	**BMEKOKAD016**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**2 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**76 hours**
Contact hours	56 hours	**Preparation for seminars**	0 hours	**Homework**	4 hours
Reading written materials	0 hours	**Midterm preparation**	8 hours	**Exam preparation**	8 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Tettamanti Tamás
12. Lecturers	Dr. Tettamanti Tamás

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Road traffic dynamics and traffic parameters. Functions and architectures of road traffic control systems. Traffic detection technologies: smoothing, filtering, prediction, Recursive Least Square Estimator, Kalman Filter, Moving Horizon Estimation. Urban and freeway traffic control: theories, strategies, tools, software. Urban road traffic modeling and control: Store-and-forward model, LQ and MPC control design. Freeway traffic modeling and control: LWR model, shockwave theory, PID / LQ / nonlinear MPC control design.

15. Description of practices

-

16. Description of laboratory practices

Road traffic modelling and traffic control algorithm realization in Matlab environment.

17. Learning outcomes

a) Knowledge:

- Organization and functioning of road traffic control systems; levels and methods of traffic modeling; urban traffic management strategies, tools and software; control systems of public transport and highway systems.

b) Ability:

- Modeling road traffic dynamics; design of traffic measurement and estimation systems.

c) Attitude:

- Open to research on traffic management and autonomous vehicles.

d) Autonomy and Responsibility:

- Independently design road traffic control.

18. Requirements, way to determine a grade (obtain a signature)

Completed homework and successful oral exam at the end of semester.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

Tettamanti T., Luspay T. and Varga I.: Road Traffic Modeling and Simulation, Akadémiai Kiadó, Budapest, 2019

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

Subject description

1. Subject name	**Security issues of Intelligent transportation systems PhD**				
2. Subject name in Hungarian	Intelligens közlekedési rendszerek védelmi kérdései PhD			**3. Role**	Specific course
4. Code	**BMEKOGGD801**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	5 hours
Reading written materials	5 hours	**Midterm preparation**	8 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Török Árpád
12. Lecturers	Dr. Török Árpád

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Critical evaluation of the scientific and professional background of IT systems. Identifying the evolution of communication channels, data formats and processes. Identifying the main developmental relationships of infections and adverse effects and identifying novel patterns of possible prevention strategies. Analysis of threats related to IT systems and implementation of new technological solutions (autonomous transport) in macroscopic traffic model.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:
- Familiar with security questions of ITS frameworks.

b) Ability:
- Ability to research and develop specific processes.

c) Attitude:
- Openness to new opportunities in the field.

d) Autonomy and Responsibility:
- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

The acquisition of the signature of the subject, and, in addition, the condition of taking exam is giving in the complete individual student homework for deadline. The exam is oral.

19. Retake and delayed completion

-

20. Learning materials

Stübing, H. (2013). Multilayered security and privacy protection in Car-to-X networks: solutions from application down to physical layer. Springer Science & Business Media.
Delgrossi, L., & Zhang, T. (2012). Vehicle safety communications: protocols, security, and privacy (Vol. 103).

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

Subject description

1. Subject name	**Security of connected vehicles**				
2. Subject name in Hungarian	Hálózatba kapcsolt gépjárművek biztonsága			**3. Role**	Basic course
4. Code	**BMEKOGGD802**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	22 hours
Reading written materials	26 hours	**Midterm preparation**	30 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Török Árpád
12. Lecturers	Dr. Török Árpád

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Development of basic processes related to the operation of networked vehicles, V2x communication, information transfer / data packets, innovative technologies in networks. Developing novel and innovative malicious interventions and detection methods. Explore deeper connections in the process of approving vehicle safety systems and assessing the safety risks associated with networked vehicles.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Familiar with connected vehicle systems.

b) Ability:

- Ability to research and develop specific processes.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and Responsibility:

- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

The acquisition of the signature of the subject, and, in addition, the condition of taking exam is giving in the complete individual student homework for deadline. The exam is oral.

19. Retake and delayed completion

-

20. Learning materials

Lemke, K., Paar, C., & Wolf, M. (2006). Embedded security in cars. Springer-Verlag Berlin Heidelberg.

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

Subject description

1. Subject name	**Selected chapters from astrodynamics**				
2. Subject name in Hungarian	Válogatott fejezetek az asztrodinamikából (PHD)			**3. Role**	Specific course
4. Code	**BMEKOMED019**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	28 hours	**Preparation for seminars**	7 hours	**Homework**	7 hours
Reading written materials	7 hours	**Midterm preparation**	0 hours	**Exam preparation**	11 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Béda Péter
12. Lecturers	Dr. Béda Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Coordinate systems of the space mechanics, time measurement. The two body problem. Elliptical planet orbits, orbit geometry, orbit elements. Near Earth orbits, solar sincronous orbits, geostationary orbits, elliptical geosynchronous orbits. large satellites: position dynamics. Dynamics of orbiting rigid bodies. Position stability of satellites. Giroscopical stabilization. Double satellite systems, satellite systems.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:
- Methods of the space mechanics.

b) Ability:
- Description of motion of planets, satellites, rockets. Model building.

c) Attitude:
- Being open to understand and learn novelties on that given domain.

d) Autonomy and responsibility:
- Evaluation and choice of optimal model elements.

18. Requirements, way to determine a grade (obtain a signature)

Semester note upon succesful realisation of the homework and an oral exam.

19. Retake and delayed completion

Essay secondary deadlines precised in the lessons requirements.

20. Learning materials

-

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

Subject description

1. Subject name	**Ship design PhD**				
2. Subject name in Hungarian	Hajótervezés PhD			**3. Role**	Specific course
4. Code	**BMEKORHD011**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	28 hours	**Preparation for seminars**	10 hours	**Homework**	12 hours
Reading written materials	4 hours	**Midterm preparation**	0 hours	**Exam preparation**	6 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Simongáti Győző
12. Lecturers	Dr. Simongáti Győző, Dr. Hargitai L. Csaba

13. Prerequisites	Ship design (KOVRM615), recommended; - (-), -; - (-), -

14. Description of lectures

The subject is able to evaluate independently the sub-tasks of ship design (definition of main dimensions, stability calculation, resistance calculation, drive design, maneuverability, structural design, etc.). They will be able to establish novel relationships in a deeper context of ship design and will be familiar with the scientific dilemmas, problems and current solutions to each subtask.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Know and understand the up to date problematics of stability calculations, problems of determination of thrust deduction factor and wake fraction, ship motion simulation methods, prediction methods for fuel consumption, new, modern application of CFD in ship design.

b) Ability:

- Able to understand and use the results of scientific publications, bale to use others knowledge for his/her own research project, able to write own publication.

c) Attitude:

- Interested, responsive, independent, take care for the deadlines.

18. Requirements, way to determine a grade (obtain a signature)

The pre-condition of the exam is the submission and acception of the own work. The exam is oral.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Hajók Kézikönyv
Dr. Benedek Z. – Hajók 1-3.
D. J. Eyres – Ship constuction
Young Bay – Marine structural design
Dr. Deseő Z. – Hajótestek szilárdsági kérdései
J S Carlton – Marine Propellers and Propulsion, Second Edition, 2007
Schnee

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

Subject description

1. Subject name	**Simulation systems and software in logistcs**				
2. Subject name in Hungarian	Szimulációs rendszerek és szoftverek logisztikai alkalmazása			**3. Role**	Basic course
4. Code	**BMEKOEAD011**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**76 hours**
Contact hours	56 hours	**Preparation for seminars**	4 hours	**Homework**	8 hours
Reading written materials	4 hours	**Midterm preparation**	4 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bohács Gábor
12. Lecturers	Dr. Bohács Gábor

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

SD simulations, DES simulations, agent-based simulations. Overview of features of modern simulation software. Typical applications for simulation systems in industry and for scientific tasks, in particular optimization of material flow systems. Presentation of the operation of modern simulation software. Trends in the development of simulation systems.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Knowledge of Logistics Simulation Software.
- Solving Logistics Problems with Simulation.
- Knowledge of development trends of logistics simulations.

b) Ability:

- It is able to combine logistics problems with the right model.
- Ability to develop a logistics simulation model.

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The grade is calculated from the grade of the individual work and the tests as an average.

19. Retake and delayed completion

Announced at the beginning of the semester.

20. Learning materials

Law, Kelton: Simulation Modeling and Analysis.

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

Subject description

1. Subject name	**Smart City**				
2. Subject name in Hungarian	Intelligens városok - Smart city			**3. Role**	Specific course
4. Code	**BMEKOKKD011**	**5. Evaluation type**	**m**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	28 hours	**Preparation for seminars**	4 hours	**Homework**	0 hours
Reading written materials	16 hours	**Midterm preparation**	12 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János, Dr. Esztergár-Kiss Domokos

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Paradigm shift in urban citizen life. Smart city introduction, evaluation and ranking methods. City planning aspects, methods and strategies. Introduction to land use functions and models. Shared spaces, public space transformation. Utilization of information received from social media and mobility patterns. Big data and Internet of Things solutions. Smart Grids and its applications. Top international and Hungarian best practices.

15. Description of practices

-

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge:

- Familiar with Smart City concept, urban planning models, social media types, mobility patterns, Big Data data types, Internet of Things model and features.

b) Ability:

- Defines Smart City features, calculates with evaluation methods, applies land use models, uses road planning principles, uses Big Data approaches, distinguishes Smart Grid elements.

c) Attitude:

- Provides maximized abilities, extends knowledge independently, strives for precise task solving.

d) Autonomy and responsibility:

- Applies acquired knowledge during the course in a responsible way, accepts the framework of cooperation, is able to work independently or in a team.

18. Requirements, way to determine a grade (obtain a signature)

There will be 2 written test during the semester, students need to pass both. The course mark will be calculated from the average of test marks.

19. Retake and delayed completion

Midterm test correction possibility for those not present on one of the tests.

20. Learning materials

Presentation slides and electronic lectrue notes.

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

Subject description

1. Subject name	**Statistics in Transport (PhD)**				
2. Subject name in Hungarian	Közlekedésstatisztika (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKKD013**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**102 hours**
Contact hours	70 hours	**Preparation for seminars**	5 hours	**Homework**	6 hours
Reading written materials	8 hours	**Midterm preparation**	5 hours	**Exam preparation**	8 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Sipos Tibor, Dr. Török Ádám

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Transport is an integral part of advanced societies. He is responsible for passenger transport, including access to services and goods and leisure mobility. He is also responsible for transporting consumer goods. Regional, national and global economies rely on efficient and safe transport. The aim of the course is the statistical analysis of data generated during transport processes. Descriptive statistics. Class interval estimation, hypothesis test, sample comparison. Linear regression. Time series analysis. Principal Component Analysis. Spatial Statistics.

15. Description of practices

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student repeats the material of the descriptive statistics and the hypothesis test.
- It learns the evolution of predictions, and thus opens up its thinking to accommodate novel solutions.
- The student will be able to specialize the general statistical problems in time and space.

18. Requirements, way to determine a grade (obtain a signature)

It is required to fulfill in time the individual student work.

19. Retake and delayed completion

The attendance requirements cannot be delayed completed. The individual case study report can be delayed submitted in the delayed completion period.

20. Learning materials

Simon P Washington; Methew G Karlaftis; Fred L. Mannering: Statsictical and Econometric Methods for Transportation Data Analysis, Taylor a& Francis; 2011

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

Subject description

1. Subject name	**Stochasic Processes in System Dynamics I.**				
2. Subject name in Hungarian	Sztochasztikus folyamatok a rendszerdinamikában I.			**3. Role**	Basic course
4. Code	**BMEKOVJD009**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	0 hours
Reading written materials	30 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Zobory István
12. Lecturers	Dr. Zobory István

13. Prerequisites	Analitical Methots in System Technique I. (BMEKOVJD001), recommended; - (-), -; - (-), -

14. Description of lectures

Stochastic excitation of a deterministic dynamical system model. Deterministic excitation of a stochastic dynamical system model: the output as a stochastic process. Horisontal and vertical characterisation of a stochastic process. The probability field. Operations among events. The relative frequency. The Lebesgue-type probability field. Roperties of the probability measure. Cpnditional probability. Conditional probability field. Conditional probability with respect to a zero probabilty condition event. Independence of events. Pair-wise and complete independence of the elements of event sequences. Complete set of events. The theorem of complete probability. The Bayes theorem. The mapping of the set of elementary events on a linear space. The linear space of random variables. Norm of linear spaces. Completeness of linear spaces. Banach spaces. Unitary linear spaces. Hilbert spaces. Real-valued, complex-valued vector-valued random variables. Stochastic sequence, stochastic process. Probability distributions, distribution function, basic properties, applications. Frequently used probability distributions. Probability density functions. Generalised density functions. Frequently used density functions. Characterisation of random variables by numerical values. Expectation, standard deviation and higher momentums. Random variables in L2. Characterisation of the Borel-measurable functions of random variables. Conection between the generator function and the characteristic function. Markov- and Cheishev-unequalities. Distribution function and density function for vector valued random variables. Marginal distribution function and density function. Expected vector and standard deviation matrix. Covariance and correlation. Condirtional distribution function and density function. Special case of zero probability condition. Conditional expectation. Regression function. Connection between two random variables. Pair-wise and complete independence of random variables. Operations among random variables, distribution of sum, product, quotient of random variables. Convergence concepts for random variable sequences. The weak law of large numbers. Central limit theorem.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: methods of the treatment of the stochastic systems and processes; probability theory and random variables, typical distribution and density functions of random variables; typical mapping procedures; the law of large numbers, central limit theorem.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Regular participation at the lectures and written exam.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Zobory, I.: Sztochasztikus folyamatok a rendszerdinamikában I. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
Arnold, L.: Sztochasztikus differenciálegyenletek Tipotex, Budapest, 2013.

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

Subject description

1. Subject name	**Stochasic Processes in System Dynamics II.**				
2. Subject name in Hungarian	Sztochasztikus folyamatok a rendszerdinamikában II.			**3. Role**	Basic course
4. Code	**BMEKOVJD010**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	15 hours
Reading written materials	15 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Zobory István
12. Lecturers	Dr. Zobory István

13. Prerequisites	Stochasic Processes in System Dynamics I. (BMEKOVJD009), recommended; - (-), -; - (-), -

14. Description of lectures

Horizontal and vertical treatment of stochastic processes. The fundamental theorem of Kolmogorov. Characteristic functions of stochastic processes. Expected value function, momentum functions and autocorrelation function. The Hilbert-space L2(□,A,P). The stochastic process as an “in-space curve” in the Hilbert-space. Some simple stochastic processes. The manifold of straight lines of random position. Stochastic differential equations, two characteristic types. Point processes, counting processes. The three conditions together result in a Poisson-process. Characteristic functions of the Poisson-process. Secondary processes generated by point process. The one-dimen¬sional marginal distribution. The one-dimensional limit-distribution. Renewal processes. Smith-theorem of the renewal theory. Operation process model for machinery systems, generated by a point process. Torque process and RPM process of the driving shaft. Determining the joint limit distribution by using the theorem of complete probability. Some simple variations for point process generated secondary process. Markov-chains and processes. Properties of the transition probability matrices. Marginal distributions of the Markov-chain. Single dimensional random walk on the integers. Stationary Markov-chains. Ergodic Markov-chains. Transition-density functions. The Chapman-Kolmogorov equation. The birth-death process. Model for the service-theory. Permanent distribution. Stationary processes. Strict- and weak stationarity of different order. Spectral properties. Ergodicity with respect to the expected value function and to the autocorrelation function. Gaussian-processes. Basic properties of the Brown-motion process. Characteristic functions of the Brown-motion process.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: characteristic operations for stochastic processes; methods of application of point processes; procedures for applying Markov-chains; applicability of Markov-chains concerning the solution to mass-service tasks; the analytic properties of stochastic processes.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Accepted homework sent before the deadline and written exam.

19. Retake and delayed completion

According to the TVSZ.

19. Learning materials

Zobory, I.: Sztochasztikus folyamatok a rendszerdinamikában I. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
Arnold, L.: Sztochasztikus differenciálegyenletek Tipotex, Budapest, 2013.

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

Subject description

1. Subject name	**Stochasic Processes in System Dynamics III.**				
2. Subject name in Hungarian	Sztochasztikus folyamatok a rendszerdinamikában III.			**3. Role**	Basic course
4. Code	**BMEKOVJD011**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	15 hours
Reading written materials	15 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Zobory István
12. Lecturers	Dr. Zobory István

13. Prerequisites	Stochasic Processes in System Dynamics I. (BMEKOVJD009), recommended; Szochasztikus folyamatok a rendszerdinamikában II. (BMEKOVJD010), recommended; - (-), -

14. Description of lectures

Transfer system characterized by a stochastic differential equation. Convergence concepts for stochastic sequences. The derivative process of a stochastic process. Harmonic oscillator excited by a stochastic process. Analytic concepts with respect to the convergence in the mean square. The transfer theorem. Tracing back the limit value, the continuity, the differentiability and the integrability in the mean square sense, to the properties of the (deterministic) autocorrelation function of the process. Characteristics in the mean square sense for second order weakly stationary processes. Level exceeding circumstances with stochastic processes. Generating realisation functions of second order weakly stationary processes. Spectral representation of second order weakly stationary processes. The concept of random measure and the stochastic integral defined on the basis of it. Stochastic characterisation of deterministic functions. The Brown-motion process and the white-noise. Characterisation of the time history of stochastic processes. The theorem of iterated logarithm. Further features of the Brown-motion process. The continuity and non-differentiability of the Brown-motion process. Generalized functions and stochastic processes. Defining stochastic integral. The stochastic integral leads to martingals. The extended definition of the conditional expectation. The extended definition of the conditional probability. Non-anticipative functions. Solutions to stochastic differential equations. The Ito-type stochastic differential equation. Existence and unicity of the solution. Reqired properties for unuque solvability of stochastic differential equation systems. The question on the existence of a global solution. Autonom stochastic differential equation. Linear stochastic differential equation. The homogeneous case. The non-homo¬geneous case. The Ornstein-Uhlenbeck process

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: solution procedures applicable for stochastic differential equations; mapping of the real processes on Markovian model.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Accepted homework sent before the deadline and written exam.

19. Retake and delayed completion

According to the TVSZ.

19. Learning materials

Zobory, I.: Sztochasztikus folyamatok a rendszerdinamikában I. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
Arnold, L.: Sztochasztikus differenciálegyenletek Tipotex, Budapest, 2013.

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

Subject description

1. Subject name	**Surface Engineering**				
2. Subject name in Hungarian	Felületi technológiák			**3. Role**	Specific course
4. Code	**BMEKOGTD016**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**44 hours**
Contact hours	10 hours	**Preparation for seminars**	0 hours	**Homework**	20 hours
Reading written materials	10 hours	**Midterm preparation**	0 hours	**Exam preparation**	4 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Markovits Tamás
12. Lecturers	Dr. Markovits Tamás

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Interpretation of surface properties, function. Friction and wear processes. Surface preparation, surface modification technologies, advanced thin films. Surface heat treatments, coatings. Thick layers: welding, metal spraying, plasma beam processes. Laser surface modification procedures.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Familiar with advanced surface modification and measuring techniques and the internal realtions of a specific processes.

b) Ability:

- Ability to research and develop specific processes.

c) Attitude:

- Openness to new opportunities in the field.

d) Autonomy and responsibility:

- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

It is necessary to prepare and submit an independent homework within the subject. The course ends with an oral exam.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Burakowski T., Wierzchon T.: Surface Engineering of Metals: Principles, Equipment, Technologies, CRC Press, 1998.
Reidenbach F.: Surface Engineering, ASM International, 1994.

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

Subject description

1. Subject name	**Technological Diagnostics**				
2. Subject name in Hungarian	Technológiai diagnosztika			**3. Role**	Specific course
4. Code	**BMEKOGTD017**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**62 hours**
Contact hours	42 hours	**Preparation for seminars**	0 hours	**Homework**	0 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	12 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Takács János
12. Lecturers	Dr. Takács János, Dr. Dömötör Ferenc

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Fundamentals and fields of technical diagnostics. Objectives and methods of defect detection. Diagnostic methods of various principles and the operation and usage characteristics of the corresponding devices. Checking the operation of some operating equipments, technologies, obtaining information about the processes. Testing possibilities in research tasks: high-speed photo and video recording, endoscopy, thermovision, force fluctuation analysis, vibration diagnostics, noise test. Non-destructive and destructive tests: acoustic emission, penetration, ultrasonic,eddy current detection, analysis of fracture surface, structural analysis. Description of the features and devices of modern diagnostic procedures and the design of tests (high-speed video recording, endoscopy, thermovision, vibration diagnostics, acoustic emission, penetration, ultrasonic and eddy current detection). Vehicle diagnostic expert systems. Evaluation and documentation of test results.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Has a deeper knowledge of fundamentals and fields of technical diagnostics.
- Knows the objectives and methods of defect detection.
- Familiar with the diagnostic methods of various principles and the operation and usage characteristics of the corresponding devices.
- Has a deeper knowledge of controlling the operation of several operating equipment and technologies, and about the methods by which information can be obtained about several processes.
- Familiar with the following test methods and their applicability in research tasks: high-speed photo and video recording, endoscopy, thermovision, force fluctuation analysis, vibration diagnostics, noise analysis.
- Familiar with destructive and non-destructive tests: acoustic emission, penetration, ultrasonic, eddy current defect detection, analysis of fracture surface, structural analysis.
- Has a deeper knowledge of the properties, devices and procedures for designing advanced diagnostic procedures (high speed video recording, endoscopy, thermovision, vibration diagnostics, acoustic emission, penetration, ultrasonic, eddy current detection).
- Has deeper knowledge of vehicle diagnostic expert systems.
- Knows the methods of evaluating and documenting test results.

b) Ability:

- Able to overview the whole and the elements of a technological process, to plan its supervision and diagnostic system.
- Able to find and analyze the causes of a process or equipment failure.
- Able to give suggestions for the development of a supervisory system.
- Capable of properly documenting and analyzing scientific results.
- Capable of a deeper, causal, scientific analysis of a technological process.
- She/he is able to gather literature on a specific research topic and compile a summary based on it.
- Able to interpret the results found in the literature.
- Able to develop a suitable experimental method for a research topic and propose test methods.
- Able to interpret test results.

c) Attitude:

- She/he strives to develop his knowledge independently.

- Strives to explore the causal relationship with scientific depth.
- Strives to develop its own topic area.
- Strives to find connections between topics and disciplines.
- Strives to interpret the literature and their own research results independently and in teamwork, listening to others' thoughts.
- Strives to share her/his knowledge.

d) Autonomy and responsibility:

- Apply responsibly the knowledge acquired during the course with regard to their validity limits.
- Manages and communicates the results of others and their own results also in accordance with ethical standards.
- Endeavors to perform his assigned tasks independently in accordance with ethical standards.
- She/he knows how far his responsibilities are, informs his colleagues or his supervisor about her/his results, and when it is necessary.

18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

Waldemar M., Sebastien D.: Infrared Thermography, Wiley, 2009.
Auxiliary materials and ppt's downloadable from the department website.

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

Subject description

1. Subject name	**Theory of Additive Manufacturing Technologies PhD**				
2. Subject name in Hungarian	Additív gyártástechnológiák elmélete PhD			**3. Role**	Specific course
4. Code	**BMEKOJSD005**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	14 hours	**Preparation for seminars**	18 hours	**Homework**	5 hours
Reading written materials	5 hours	**Midterm preparation**	18 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Ficzere Péter
12. Lecturers	Dr. Ficzere Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Description of design methods. Applications of additive manufacturing technologies. Applications of additive manufacturing technologies. Principle of additive manufacturing technologies. An overview of additive manufacturing processes. Case study. Generation of inputs needed for additive manufacturing, their overview. Examination of the effects of settings and production parameters. Economic Issues in Additive Manufacturing Technologies. Accuracy of manufacturing and loadability issues. Strength dimensioning of parts made by additive manufacturing. Manufacturing Simulation options. Overview of Materials Used for Additive Manufacturing

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Knowledge of recognization the applicability and cost effectiveness of additive manufacturing
- Knowledge of the recognization of the problems that may arise during additive manufacturing based on CAD models and how to eliminate them.
- Knowledge of the appropriate technology selection based on part / model requirements

b) Ability:

- Able to select and coordinate the appropriate manufacturing technology on the basis of any 3D model and individual part requirements
- Able to create the needed format to CAM software with an accurate enough based on any 3D model file
- Able to define the appropriate settings, manufacturing parameters and generating the code required for the machine
- Able to the manufacturing parts, including pre- and post-production

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The acquisition of the signature of the subject, and, in addition, the condition of taking exam is giving in the complete individual student homework for deadline. The exam is oral.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Dr. Ficzere Péter, Az additív gyártástechnológiák elmélete diasor

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

Subject description

1. Subject name	**Traffic Technology (Modells) (PhD)**				
2. Subject name in Hungarian	Forgalomtechnika (modellezés) (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKUD009**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**0 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	28 hours	**Preparation for seminars**	0 hours	**Homework**	20 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	4 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Juhász János
12. Lecturers	Dr. Juhász János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Microscopic characteristics of road traffic. Overview of simulation modelling methods. Definition and collection of data necessary for modelling. Use of microscopic models. Structure, peculiarities and practical application of the VISSIM program. Simulation of pedestrian traffic. Study of multimodal node traffic using microscopic simulation methods.

15. Description of practices

Exercising theoretical knowledge with examples and case studies.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Knows the microscopic characteristics of road traffic.
- Knows the methods of simulation modelling.
- Knows the models of the traffic process (traffic flow) and the behavior of transport operators.
- Knows the methods of microscopic modelling of pedestrian traffic flow.

b) Ability:

- Able to examine road traffic using a microscopic simulation model.
- Able to apply the VISSIM program in practice to examine the flow of vehicle and pedestrian traffic, to compare different traffic control methods.
- Able to make a comparative analysis of design multimodal node design variants with microscopic simulation.

c) Attitude:

- The student attends the lectures, prepare independent study on time.
- During the lectures, he is actively involved in processing the current topic.
- During the independent study the student strives to develop new technical solutions.
- Interested in international and domestic developments in the field.
- Open to learn new knowledge and learn.

d) Autonomy and responsibility:

- Apply responsibility the knowledge acquired in the course of the course.
- Can independently develop new technical solutions.
- Accepts the framework of collaboration, can perform its work independently or as part of a team, depending on the task.

18. Requirements, way to determine a grade (obtain a signature)

Exam. Evaluation of individual study.

19. Retake and delayed completion

Retake exam. Study repair.

20. Learning materials

Supported by downloadable documents from the Department website.

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

Subject description

1. Subject name	**Transport Economics I (PhD)**				
2. Subject name in Hungarian	Közlekedésgazdaságtan I (PhD)			**3. Role**	Basic course
4. Code	**BMEKOKGD006**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	28 hours	**Homework**	12 hours
Reading written materials	16 hours	**Midterm preparation**	20 hours	**Exam preparation**	16 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Táczos Lászlóné, Dr. Török Ádám

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Mapping the relationship between economic policy and transport policy. Main features of Hungary's transport, main directions of change and their relation to the EU transport policy. Mathematical background of transport economics. Mathematical methods for determining external costs and possibilities for their internalization. Transport and Space Economy. Transport demand planning. Cost of transportation. Optimal community decisions. Competition and regulation.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student will be able to identify the relationship between economic policy and transport policy.
- The student gets acquainted with the main features of transport, the main directions of change and the main questions of their mathematical modeling.
- The student acquires and becomes able to interpret and develop the mathematical background of transport economics.

18. Requirements, way to determine a grade (obtain a signature)

It is required to fulfill in time the individual student work.

19. Retake and delayed completion

The attendance requirements cannot be delayed completed. The individual case study report can be delayed submitted in the delayed completion period.

20. Learning materials

André de Palma , Robin Lindsey , Emile Quinet , Roger Vickerman (2011) A Handbook Of Transport Economics, Edward Elgar, 928 pp, ISBN 978 1 84720 203 1

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

Subject description

1. Subject name	**Transport Economics II (PhD)**				
2. Subject name in Hungarian	Közlekedésgazdaságtan II. (PhD)			**3. Role**	Basic course
4. Code	**BMEKOKGD007**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	28 hours	**Homework**	12 hours
Reading written materials	16 hours	**Midterm preparation**	20 hours	**Exam preparation**	16 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Táczos Lászlóné, Dr. Török Ádám

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Mathematical background of transport economics. Modeling of passenger and freight transport demand and supply. Mathematical basics of pricing and charging in transport. Social acceptance of awards. Asset management and technical development tasks in transport, some sub-sector specificities. Expenditures. Externalities. Demand Planning. Investment and Pricing. Regulation and privatization. Impact of transport policy.

15. Description of practices

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student learns the mathematical background of transport economics.
- The student will be able to interpret the modeling of passenger and freight needs and supply.
- After acquiring the mathematical foundations of pricing and pricing, the student becomes more receptive to new solutions to transport problems.
- The student learns and is able to use the tools of social acceptance of awards.

18. Requirements, way to determine a grade (obtain a signature)

It is required to fulfill in time the individual student work.

19. Retake and delayed completion

The attendance requirements cannot be delayed completed. The individual case study report can be delayed submitted in the delayed completion period.

20. Learning materials

Chris Nash (2015) Handbook of research methods and application in Transport Economics and Policy, Edward Elgar, 455 pp, ISBN 978 0 85793 792 6

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

Subject description

1. Subject name	**Transport Informatics (PhD)**				
2. Subject name in Hungarian	Közlekedési informatika (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKUD002**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**2 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	34 hours
Reading written materials	20 hours	**Midterm preparation**	14 hours	**Exam preparation**	10 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Csiszár Csaba
12. Lecturers	Dr. Csiszár Csaba, Csonka Bálint, Földes Dávid

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Features of road electromobility system. Information system and services of electromobility, smart grid. Transportation system based on autonomous vehicles, mobility service types, impacts. Planning and operation of mobility services based on autonomous vehicles. Structure of transportation system, basic concepts in informatics. Structural model of transportation information systems. Characteristics and categorization of transportation organizations. Operational models of transportation organizations. Analysis and modelling methods of transportation information systems.

15. Description of practices

Basic terms and main application fields of artificial intelligence, calculation examples. Rudiments of system planning. Case studies. The students elaborate a customized complex assignment for modelling and planning information system aiding transportation operation.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The students know structure and operation of complex transportation information systems.
- They are able to analyse and design transportation information systems and operational processes.

b) Attitude, Autonomy and responsibility:

- The students strive for precise and errorless task accomplishment.
- They apply the knowledge with responsibility.
- They are able to work independently or in a team according to the situation.

18. Requirements, way to determine a grade (obtain a signature)

The students write 4 midterms. 2 of them include theoretical questions; 2 of them include practical questions. The mid-semester signature is obtained if all the four midterms are passed (half of the max-imal scores) and the student assignment about data modelling is submitted and accepted (at least half of the maximal scores). The semester is finished by oral exam.

19. Retake and delayed completion

The midterms can be retaken according to TVSZ (study code). The student assignment can be submitted after deadline (if extra fee is paid).

20. Learning materials

Ppt slides, Csaba Csiszár – Bálint Csonka – Dávid Földes: Innovative Passenger Transportation Systems (book) (2019), Dr. Csiszár Csaba – Caesar Bálint – Csonka Bálint – Földes Dávid: Transportation Information Systems I. Study-aid for practices in computer laboratory (2016)

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

Subject description

1. Subject name	**Transport Infrastructure and Regional Development**				
2. Subject name in Hungarian	Transport Infrastructure and Regional Development			**3. Role**	Specific course
4. Code	**BMEKOKKD006**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**1 lecture**	**1 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	22 hours
Reading written materials	18 hours	**Midterm preparation**	0 hours	**Exam preparation**	8 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Mészáros Ferenc
12. Lecturers	Dr. Mészáros Ferenc

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Transport infrastructure and developement are linkled, although the link between them is not straightforward. This course explores and analyses this link. Regional development and its measurement is scrutinized as is the monetarisation of infrastructure charging and calculatiuon of costs. The course engages the disciplines of economics, regional planning, environmental science, geography, and sociology in investigating the externalities of transportation. The course aims to provide a practical and contemporary, but yet critical introduction to this subject. It will involve the study real and contemporary examples.

15. Description of practices

Definition of regional development. Indicators of sustainable regional development and green economics. Pricing transport use: charges, elasticites, time saving and road pricing. Describing relationship between transport improvements and economic activity. Traffic and transport infrastructure in condition of suppressed demand. Traffic demand management and reallocation of road space. Transport externalities: congesion on the road network, air pollution and greenhouse gas emission, noise annoyance, spatial inequalities and urban sprawl, social inequalities. Financing transport infrastructures. European policy on transport infrastructure and regional development.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- The student knows the definitions and interrelations of transport infrastructure and regional developments, gets know the sustainability goals and indicators.

b) Ability:
- The student is able to identify and calculate/evaluate the wider impacts of transport infrastructure investments on the regional development.

c) Attitude:
- The student strives for completeness in the acquisition of knowledge, co-operates with the teacher and the other students, is open towards new and innovative ideas, researches and uses information technology and computing tools for its work.

d) Autonomy and responsibility:
- In addition to the narrow professional aspects, the student also takes into account social and economic aspects in the utilization of its knowledge, asks for the professional opinions of others, makes responsible decisions in the selection of the most efficient transport investments, and takes care of the challenges responsibly.

18. Requirements, way to determine a grade (obtain a signature)

The students shall attend the at least 70% of lectures and at least 70% of seminars. The students shall individually work out a report about a selected and agreed case study analysis about wider impacts of a transport infrastructure investment and submit until the last day of study period. There are two assessments during the semester: (1) a formative assessment is conducted based on continuous performance and activity at the subject's contact lessons (active participation, contributing thoughts, participation in organised teamwork and discussions, etc.) (signature, weight of 70% in final grade), (2) a formative assessment during the verbal exam based on the student's case study analysis with brief presentation (weight of 30% in final grade).

19. Retake and delayed completion

The attendance requirements cannot be delayed completed. The individual case study report can be delayed submitted in the delayed completion period.

20. Learning materials

Caralampo Focas (2006) Transport Infrastructure and Regional Development. Course material, BME Department of Transport Economics, Budapest
Eddy Van de Voorde, Thierry Vanelslander (2010) Applied Transport Economics, De Boeck
André de Palma , Robin Lindsey , Emile Quinet , Roger Vickerman (2011) A Handbook Of Transport Economics, Edward Elgar
Lecture slides

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

Subject description

1. Subject name	**Transport Logistics**				
2. Subject name in Hungarian	Szállítási logisztika			**3. Role**	Specific course
4. Code	**BMEKOALD006**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**3 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	42 hours	**Preparation for seminars**	7 hours	**Homework**	30 hours
Reading written materials	11 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Kovács Gábor
12. Lecturers	Dr. Kovács Gábor

13. Prerequisites	Packaging Technologies (BMEKOALD005), recommended; - (-), -; - (-), -

14. Description of lectures

Modern methods and optimization problems of goods transportation. The vehicle routing problem and traveling salesman problem (selected notes). Solving methods: analytic, heuristic, metaheuristics algorithms. The ant colony and genetic algorithm for solving TSP and VRP tasks. The transportation network structure optimization, decision supporting.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Knowledge of the modular structure and operation of the transport logistics systems.
- Knowledge of related optimum search tasks and solutions.

b) Ability:

- Able to study the transport logistics systems, taking into account the scientific requirements.
- Able to carry out research and development tasks related to the transport logistics systems.

c) Attitude:

- Strive to maximize their abilities to make their studies at the highest possible level, with a profound and independent knowledge, accurate and error-free, in compliance with the rules of the applicable tools, in collaboration with the instructors.

d) Autonomy and responsibility:

- Take responsibility for the quality of the work and the ethical standards that set an example for the classmates, using the knowledge acquired during the course.

18. Requirements, way to determine a grade (obtain a signature)

The grade of the PhD student is based on the semester activity and the evaluation of the paper (publishing), in consultation with the supervisor.

19. Retake and delayed completion

Announced at the beginning of the semester.

20. Learning materials

Slides and examples in electronic format.

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

Subject description

1. Subject name	**Transport Network Planning (models) (PhD)**				
2. Subject name in Hungarian	Közlekedési hálózattervezés (modellek) (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKUD008**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**1 lecture**	**0 practice**	**1 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for seminars**	0 hours	**Homework**	30 hours
Reading written materials	10 hours	**Midterm preparation**	12 hours	**Exam preparation**	10 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János, Aba Attila

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Transport network systems and their elements, the aim and process of transport network planning. The characteristics of transport demands. The elements of transport models, their application in network building. Transport network planning models: Trip generation, trip distribution, modal choice, traffic assignment. Detailed examination of traffic assignment models.

15. Description of practices

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16. Description of laboratory practices

The software of Transport network planning is introduced.

17. Learning outcomes

a) Knowledge:

- Familiar with goal and process of transport network planning.

b) Ability:

- Ability to use of VISUM szoftver.

c) Attitude:

- Strive to acquire the highest level of system approach.

d) Autonomy and responsibility:

- Responsible applies of acquired knowledge in individual or in team work.

18. Requirements, way to determine a grade (obtain a signature)

The criterion of the signature (and to take the exam) is to solve the chosen project till the deadline and to write the midterm exam at least an acceptable level. The exam is written.

19. Retake and delayed completion

Second test possibility for those not present on the test, possibility of delayed deadline for home work.

20. Learning materials

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

Subject description

1. Subject name	**Transport Technology (PhD)**				
2. Subject name in Hungarian	Közlekedési technológia (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKUD003**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**90 hours**
Contact hours	28 hours	**Preparation for seminars**	8 hours	**Homework**	20 hours
Reading written materials	4 hours	**Midterm preparation**	20 hours	**Exam preparation**	10 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Mándoki Péter
12. Lecturers	Dr. Mándoki Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The subject of the course is to introduce and deepen the knowledge of road, rail and urban transport technology. Describe the processes of passenger and freight transport, the linkages between sectors and the division of labour. Technical parameters of road traffic. Special tools for urban public transport and their operation. Features of rail transport. Main, secondary and auxiliary processes of the railway operating system. Self-driving vehicles and automatic operation in public transport.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- The student knows and understands the characteristics, fields of application and planning techniques of each transport sub-sector.

b) Ability:

- Ability to dealing with creative problems in the field of transport and flexible solutions to complex tasks. Able to plan technological processes, taking into account their operational aspects. Able to working in a group, sharing tasks and managing them over time.

c) Attitude:

- Engages in professional and ethical values related to the technical field, and works based on a system-oriented and process-oriented mindset, in a team-work.

d) Autonomy and responsibility:

- Make his decisions carefully, in consultation with representatives of other fields of expertise, with full responsibility. n the case of team work, he also works with a well-defined responsibility

18. Requirements, way to determine a grade (obtain a signature)

Exam, which included the results of individual tasks 50% weighting.

19. Retake and delayed completion

Unsuccessful task can be replaced during the replacement period.

20. Learning materials

Uploaded materials to theMoodle System and the Department website.

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

Subject description

1. Subject name	**Tribology**				
2. Subject name in Hungarian	Tribológia			**3. Role**	Specific course
4. Code	**BMEKOGTD005**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**48 hours**
Contact hours	28 hours	**Preparation for seminars**	0 hours	**Homework**	0 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	12 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Takács János
12. Lecturers	Dr. Takács János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The concepts of tribology, investigation and analysis of its processes. Surface of solid bodies, topography. The concept of friction, factors that affect friction. The relationship between friction and wear. The role and characteristics of lubricants. Lubrication systems. Wear-related phenomena, wear mechanisms: adhesion, abrasion, oxidation, fatigue wear; and their relationships. Modeling of wear processes, wear testers and equipments. Wear assessment, wear charts. Opportunities to reduce wear and increase lifetime. Choosing material pairs for parts. Developing advanced surfaces for increased wear resistance. Choice of lubricant and lubrication system related to stress and material pairing. Increase lifetime.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Has a deeper knowledge of the surface and topography of solid bodies. Knows the concept of friction. Has a deeper knowledge of the factors that affect friction. Knows the relationship between friction and wear. Knows the role and characteristics of lubricants and the different lubrication systems. Has a deeper knowledge of wear-related phenomena and wear mechanisms: adhesion, abrasion, oxidation, fatigue wear; and their relationships. Has a deeper knowledge of modeling wear processes. Knows the wear testers and equipments. Has deeper knowledge of wear assessment and wear charts. Knows the possibilities of abrasion reduction and lifetime increase. Knows the principles of choosing material pairs of parts. Knows the methods of creating advanced surfaces that provide increased wear resistance. Knows the principles of choosing a lubricant and lubrication system related to stress and material matching. Has a deeper understanding of lifetime improvement methods.

b) Ability:

- Able to propose a material matching, lubrication system and surface modification procedure for a load condition system. Able to overview a technological or measurement process and capable of a deeper, causal, scientific analysis of it. Able to give suggestions for the development of a technological or measurement process. She/he is able to gather literature on a specific research topic and compile a summary based on it. Able to interpret the results found in the literature. Able to develop a suitable experimental method for a research topic and propose test methods. Able to interpret test results.

c) Attitude:

- She/he strives to develop his knowledge independently. Strives to explore the causal relationship with scientific depth. Strives to develop its own topic area. Strives to find connections between topics and disciplines. Strives to interpret the literature and their own research results independently and in teamwork, listening to others' thoughts. Strives to share her/his knowledge.

d) Autonomy and responsibility:

- Apply responsibly the knowledge acquired during the course with regard to their validity limits. Manages and communicates the results of others and their own results also in accordance with ethical standards. Endeavors to perform his assigned tasks independently in accordance with ethical standards. She/he knows how far his responsibilities are, informs his colleagues or his supervisor about her/his results, and when it is necessary.

18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

Bhushan B.: Introduction to Tribology, John Wiley & Sons, 2002.

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

Subject description

1. Subject name	**Vehicle Manufacturing Systems**				
2. Subject name in Hungarian	Járműgyártó rendszerek			**3. Role**	Basic course
4. Code	**BMEKOGTD014**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**84 hours**
Contact hours	56 hours	**Preparation for seminars**	0 hours	**Homework**	12 hours
Reading written materials	4 hours	**Midterm preparation**	0 hours	**Exam preparation**	12 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Takács János
12. Lecturers	Dr. Takács János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The aim of this subject to give research and development approach to design, build, and modernise manufacturing systems of vehicles and those parts. Construction of vehicle manufacturing systems; equipments of product production as system components. Designing components for build up and cut of technologies (cutting tools with definite and indefinite edge geometry, bulk forming tools). Design, manufacture, measurement and renewal of tools. Design, manufacture and renewal of workpiece clamping and tool guiding devices. Tooling up and equipping machines. Design and dimensioning of measuring instruments. Installation and arrangement of vehicle manufacturing systems.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- Knows the structure of vehicle manufacturing systems. Has a deeper knowledge of designing, manufacturing, measuring and renewal of tools.
- Has a deeper knowledge of the design, manufacture and renewal of workpiece clamping and tool guiding devices.
- Knows the process of machine tooling and equipping. Has a deeper knowledge of the design and dimensioning of measuring instruments.
- Has a deeper knowledge of the installation of vehicle manufacturing systems and the design of the plant layout.

b) Ability:
- It is able to overview and plan the whole technological process (plant layout) and its elements (equipping, tooling, measurement).
- Capable of a deeper, causal, scientific analysis of a technological process. Able to give suggestions for the development of a technological process. She/he is able to gather literature on a specific research topic and compile a summary based on it.
- Able to interpret the results found in the literature. Able to develop a suitable experimental method for a research topic and propose test methods. Able to interpret test results.

c) Attitude:
- She/he strives to develop his knowledge independently. Strives to explore the causal relationship with scientific depth.
- Strives to develop its own topic area. Strives to find connections between topics and disciplines.
- Strives to interpret the literature and their own research results independently and in teamwork, listening to others' thoughts.
- Strives to share her/his knowledge.

d) Autonomy and responsibility:
- Apply responsibly the knowledge acquired during the course with regard to their validity limits.
- Manages and communicates the results of others and their own results also in accordance with ethical standards.
- Endeavors to perform his assigned tasks independently in accordance with ethical standards. She/he knows how far his responsibilities are, informs his colleagues or his supervisor about her/his results, and when it is necessary.

18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

Kalpakijan S.: Manufacturing Engineering and Technology, Prentice Hall, 2013
Flinn R. A., Trojan P. K.: Engineering Materials and Their Applications, Houghton Mifflin Co International Inc., 1989.

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

Subject description

1. Subject name	**Vehicle Materials**				
2. Subject name in Hungarian	Járműszerkezeti anyagok			**3. Role**	Basic course
4. Code	**BMEKOGGD002**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**4 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**84 hours**
Contact hours	56 hours	**Preparation for seminars**	0 hours	**Homework**	8 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	12 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Bán Krisztián
12. Lecturers	Dr. Bán Krisztián

13. Prerequisites	Advanced materials and technologies (BMEKOGGM601), recommended; - (-), -; - (-), -

14. Description of lectures

Giving high-level theoretical knowledge of vehicles structural materials, manufacturing processes of vehicle parts. Features and development directions of automotive pre-production technologies. Impact of impurities and alloys on mechanical properties of steels. Classification of steels by composition and use. Heat treatment technologies for steels. Advanced high strength steels. Cast irons. Types and properties of cast iron, heat treatment technologies for property modifications. Impact of impurities and alloys on the mechanical properties of non-ferrous and lightweight metals. Classification of non-ferrous and lightweight metals according to their composition and use. Heat treatment technologies for property modifications of non-ferrous and lightweight metals. Bulk plastic deformation technologies and sheet metal forming. Main properties of plastics (structure, mechanical properties, transformation temperatures). Test methods for plastics. Plastics processing technologies. Properties of composite materials, production technologies (metal foams, in situ composites,fibre-reinforced composites). Properties of ceramics, manufacturing techniques of ceramic components. Surface modification procedures.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Knows the pre-production technologies of Fe-based, non-ferrous and lightweight metals.
- Has a deeper knowledge of impact of impurities and alloys on mechanical properties of steels.
- Knows the classification of steels by composition and use.
- Has a deeper knowledge of heat treatment technologies for steels.
- Has a deeper knowledge of types, structure and properties of advanced high strength steels.
- Has a deeper knowledge of types and properties of cast iron, heat treatment technologies for property modifications.
- Has a deeper knowledge of impact of impurities and alloys on the mechanical properties of non-ferrous and lightweight metals.
- Knows the classification of non-ferrous and lightweight metals according to their composition and use.
- Has a deeper knowledge of heat treatment technologies for property modifications of non-ferrous and lightweight metals.
- Has a deeper knowledge of bulk plastic deformation technologies and sheet metal forming.
- Has a deeper knowledge of main properties of plastics (structure, mechanical properties, transformation temperatures).
- Knows test methods for plastics.
- Knows plastics processing technologies.
- Has a deeper knowledge of properties of composite materials, production technologies (metal foams, in situ composites, fibre-reinforced composites).
- Has a deeper knowledge of properties of ceramics, manufacturing techniques of ceramic components.
- Has a deeper knowledge of surface modification procedures.

b) Ability:

- Able to overview a technological or measurement process and capable of a deeper, causal, scientific analysis of it.
- Able to give suggestions for the development of a technological or measurement process.
- She/he is able to gather literature on a specific research topic and compile a summary based on it.
- Able to interpret the results found in the literature.
- Able to develop a suitable experimental method for a research topic and propose test methods.
- Able to interpret test results.

c) Attitude:

- She/he strives to develop his knowledge independently.
- Strives to explore the causal relationship with scientific depth.

- Strives to develop its own topic area.
- Strives to find connections between topics and disciplines.
- Strives to interpret the literature and their own research results independently and in teamwork, listening to others' thoughts.
- Strives to share her/his knowledge.

d) Autonomy and responsibility:

- Apply responsibly the knowledge acquired during the course with regard to their validity limits.
- Manages and communicates the results of others and their own results also in accordance with ethical standards.
- Endeavors to perform his assigned tasks independently in accordance with ethical standards.
- She/he knows how far his responsibilities are, informs his colleagues or his supervisor about her/his results, and when it is necessary.

18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

19. Retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

20. Learning materials

Thornton, Calangelo: Fundamentals of engineering materials, Prentice-Hall, Inc. New Jersey, 1985,
Flinn, Trojan: Engineering Materials and Their Applications,
Kalpakijan S.: Manufacturing Engineering and Technology, Prentice Hall, 2013.
Auxiliary materials and ppt's downloadable from the department website.

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

Subject description

1. Subject name	**Vehicle system dynamics I.**				
2. Subject name in Hungarian	Járműrendszerdinamika I.			**3. Role**	Basic course
4. Code	**BMEKOVJD007**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	0 hours
Reading written materials	30 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Zobory István
12. Lecturers	Dr. Zobory István

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Investigation method used for treating the problems of system dynamics. System identification via the least-squares' method. Characterisation of mechanical systems by means of logical flow-charts. Logical flow-chart of vibration system excited by kinematical load or force load. Logical flow chart of a block braked vehicle wheel taking into consideration the tribological characteristics of the sliding friction and the rolling contact. Flow chart for the starting process of a vehicle drive system. Dynamical model of the speed regulator system for a Diesel-engine. Simplified flow-chart of the engine – regulator system. Construction of the system equations of the regulator taking into consideration an ideal engine, sliding friction as well as a hydraulic amplifier. Representation of dynamical systems by structure graph. Analogies between mechanical and electric systems. Description of the node and loop equations of dynamical networks. Elementary relations for the source-free bows. Mechanical impedance. Examples for the construction of structure graphs of excited and damped vibratory systems in the presence of complex valued periodic and non-periodic excitations. Representation of dynamical systems by signal flow graph. Construction of the motion equations of lumped parameter dynamical systems by synthetic and analytic methods. Lagrangean equations of second kind. The general theory of linear dynamical systems. System description in the time domain: the weighting function and the transition function. Treating of the systems with excitation: the convolution integral and the Duhamel-integral. System description in the frequency domain. The complex frequency function. Analysis of the reponse of linear systems excited by periodic, non-periodic or in 2nd order weakly stationary random excitations. Analysis of the outputs in the case of MIMO system. The coherency function and its applications.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: application of flow-charts, structure graphs and signal-flow-graphs for analysing vehicle dynamical systems; analytic and sintetic methods for generation motion equations; methods of characterisation of dynamic systems in the time- and frequenty-domains.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasource activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Regular participation at the lectures and written exam.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Zobory, I.: Járműrendszerdinamika I. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
Brown, F.T.: Engineering System Dynamics. Taylor & Francis, Boca Raton, London, New-York, 2007

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

Subject description

1. Subject name	**Vehicle system dynamics II.**				
2. Subject name in Hungarian	Járműrendszerdinamika II.			**3. Role**	Basic course
4. Code	**BMEKOVJD008**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	0 hours
Reading written materials	30 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Zobory István
12. Lecturers	Dr. Zobory István

13. Prerequisites	Vehicle system dynamics I. (BMEKOVJD007), recommended; - (-), -; - (-), -

14. Description of lectures

Characterisation of the connection forces arising between structural components. Force processes emerging in a damped linear vibratory system. The vibratory system, as a closed effect-chain system with feed-back. Bivariate continuous characteristic connection force surface in linear and nonlinear cases. Discontinuous connection force characteristic surfaces. Dry friction dampers. Taking into consideration the local elasticity. The effect of the sliding speed dependent friction coefficient on the characteristic surface. Deduction of the description of the force connection having short distance memory, for numerical applications. Treatment of the antedecent-dependence by an assembly of local planes. Defining a path-band on the motion-state plane. Equilibrium state on the local plane. Connection with the catastrophe theory. Double path-band on the motion-state plane. Non smooth dynamics. Examples for systems with friction connection. Time dependent (controlled) frictional limit-force. Conditional force-connections. Only compressive force transfer. Only tensile force transfer. Connection with back.lash. Conditional connections working against each other. The effect of linear damping on the conformation of the conditional connection force. Introduction of the local elasticity. Conditional connection tightened against each other. Dynamics and tribology of rolling contacts. Tractions arising on the contact surface. Stationary rolling in the presence of creep-dependent connection force. The Kalker-theory for the linearized connection force transfer. The five parameter non-linear function of the force connection coefficient. The naiv stochastic model of the force connection coefficient. The force connection cefficient as a two parameter stochastic field. Semi-Markovian carrier process and a stationary fluctuation process as a function of the distance covered by rolling. Characterisation of the real contact conditions. Wear process of rolling connections. Relation between the dissipated energy-flow density and the debris mass-flow density. Wear simulation. Smoothing problems.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: the linear and non linear force connections of vehicle dynamical systems; description methods of the rolling connection; procedures describing the wear mechanism of the rolling connection.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Regular participation at the lectures and written exam.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Zobory, I.: Járműrendszerdinamika I. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
Brown, F.T.: Engineering System Dynamics. Taylor & Francis, Boca Raton, London, New-York, 2007

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

Subject description

1. Subject name	**Vehicle system dynamics III.**				
2. Subject name in Hungarian	Járműrendszerdinamika III.			**3. Role**	Basic course
4. Code	**BMEKOVJD014**	**5. Evaluation type**	**e**	**6. Credits**	**4**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	30 hours	**Homework**	0 hours
Reading written materials	30 hours	**Midterm preparation**	0 hours	**Exam preparation**	32 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Szabó András
12. Lecturers	Dr. Szabó András

13. Prerequisites	Vehicle system dynamics II. (BMEKOVJD008), recommended; - (-), -; - (-), -

14. Description of lectures

Distributed parameter beam model of the transportation track on elastic foundation. Treatment of the moving load acting on the track model. Models of system dynamics: lumped parameter models, distributed parameter models and hybrid models. Connecting the track/vehicle models, complex model formation. The degree of freedom of the models. Constraint equations. Gravity point position characterising free coordinates and acceleration-coupled systems. Forces arising in the track/vehicle system. Geometric and parametric track irregularities acting on the system as excitation effects. Generation of the motion equations of the system by synthetic method. Specifying the wheel and rail profiles. Computing the normal forces acting on the rail surface. Prediction of the wheel and rail wear by simulation. Conditions of the stable running. Numerical stability analysis. Nonlinear effects after loss of dynamical stability, the limit-cycle motion. The lateral dynamical model of the railway track/vehicle system using the continuum model of the track. Numerical simulation. Beam models of different detail level of the railway track for moving vertical loads. Solution to the boundary value problem. Treatment of the complex coefficient algebraic equation emerging in the course of the numerical analysis. The combined modelling of the track and the lumped parameter vehicle moving along it, as a hybrid dynamical system.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: possibilities for modelling the railway-track/vehizle dynamical system; methods of generating the system-equations; transformation procedures connected to the system modelling; solution methods for the geometrical contact of wheel and rail; possibilities of taking into consideration the parametric excitation caused by the track stiffness inhomogenity.

b) Attitude, Autonomy and responsibility:

- Students must persue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new reasurce activities in new fields of knowledge in an innovative way.

18. Requirements, way to determine a grade (obtain a signature)

Regular participation at the lectures and written exam.

19. Retake and delayed completion

According to the TVSZ.

20. Learning materials

Szabó, A.: Járműrendszerdinamika III. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2012.
Zoller, V.: Elosztott paraméteres és hibrid drinamikai rendszerek. BME Vasúti Járművek és Jármű-rendszeranalízis Tanszék. Budapest, 2011.
Zábori, Z.. Hibrid közlekedési pálya-jármű rendszer keresztirányú dinamikája. Kézirat. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2010.

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

Subject description

1. Subject name	**Vehicle system dynamics PhD**				
2. Subject name in Hungarian	Gépjárműrendszerek dinamikája PhD			**3. Role**	Specific course
4. Code	**BMEKOGJD004**	**5. Evaluation type**	**e**	**6. Credits**	**3**
7. Weekly contact hours	**2 lecture**	**0 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	28 hours	**Preparation for seminars**	14 hours	**Homework**	22 hours
Reading written materials	26 hours	**Midterm preparation**	30 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

The subject discusses in detail driving dynamics, stability and vibrations of road vehicles using toolkits of linear and nonlinear dynamics. Architectures of systems acting the dynamics of the vehicle independent of the driver.

15. Description of practices

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16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:
- Familiar with vehicle dynamics fundamnetals.

b) Ability:
- Ability to research and develop specific processes.

c) Attitud:
- Openness to new opportunities in the field.

d) Autonomy and responsibility:
- Participate in independent research tasks.

18. Requirements, way to determine a grade (obtain a signature)

The acquisition of the signature of the subject, and, in addition, the condition of taking exam is giving in the complete individual student homework for deadline. The exam is oral.

19. Retake and delayed completion

There is one occasion to retake the exam.

20. Learning materials

Hans Pacejka: Tire and Vehicle Dynamics, Elsevier B-ELS-049, ISBN of 9780080970172, 2012.
Tire and Wheel Technology, 2011, SAE International SP-2296, ISBN of 978-0-7680-4735-6, 2011.
Vehicle Dynamics Stability and Control, 2011, SAE International SP-2297, ISBN of 978-0-7680-4736-3, 2011.
Rao V. Dukkipati, Jian Pang, Mohamad S. Qatu, Gang Sheng, Zuo Shuguang, Road Vehicle Dynamics, SAE International, R-366, ISBN of 978-0-7680-1643-7, 2008.

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

Subject description

1. Subject name	**Work Organisation and Management (PhD)**				
2. Subject name in Hungarian	Üzemszervezés (PhD)			**3. Role**	Specific course
4. Code	**BMEKOKUD011**	**5. Evaluation type**	**e**	**6. Credits**	**2**
7. Weekly contact hours	**1 lecture**	**1 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**60 hours**
Contact hours	28 hours	**Preparation for seminars**	0 hours	**Homework**	20 hours
Reading written materials	8 hours	**Midterm preparation**	0 hours	**Exam preparation**	4 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Juhász János
12. Lecturers	Dr. Juhász János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

Types of process indicators, methods of their calculation. Relationships between the indicators. Using of the fact-finding and process testing methods. Calculation of the capacity and capacity consumption of the transportation, open reserve. Methods of capacity consumption increasing. Organization methods and tools of production systems. The basics of organization of production systems: relationships between production types and systems. Automation and integration of production. Flexible production systems. Design methods of spatial layout of production equipment. Time planning of production, transport and logistics processes. Using of Gantt Chart. Examination of process and characteristics of production by simulation methods. Introduction to Lean methods application. The effect of Industry 4.0 and Artificial Intelligence for work organization.

15. Description of practices

Exercising theoretical knowledge with examples and case studies.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge:

- Know the operational indexes of operational processes in the practice.
- Know the methods and tools of organizing production systems.
- Know the characteristics of different production systems.
- Know the methods of time planning of production and transport processes.
- Know the basic concepts of Lean and application possibilities.
- Know the application of artificial intelligence in production systems.
- Know the relationship between Industry 4.0 and operating methods.

b) Ability:

- Able to evaluate the development of indicators for the classification of operational and transport processes.
- Able to time planning of production and transport processes. Able to apply of Industry 4.0 elements.

c) Attitude:

- The student attends the lectures, prepare independent study on time.
- During the independent study the student strives to develop new technical solutions.
- Interested in international and domestic developments in the field.
- Open to learn new knowledge and learn.

d) Autonomy and responsibility:

- Apply responsibility the knowledge acquired in the course of the course.
- Can independently develop new technical solutions.
- Accepts the framework of collaboration, can perform its work independently or as part of a team, depending on the task.

18. Requirements, way to determine a grade (obtain a signature)

Exam. Evaluation of individual study.

19. Retake and delayed completion

Retake exam. Study repair.

20. Learning materials

Supported by downloadable documents from the Department website

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

Subject description

1. Subject name	**Dissertation writing (1)**				
2. Subject name in Hungarian	Disszertáció készítése (1)			**3. Role**	Mandatory
4. Code	**BMEKOALD171**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Formulation of the main theses of the doctoral research, preparation of the draft of the dissertation.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: Theses and publications are organized together, the table of content is ready; good: the theses have been formulated, publications based on theses are appropriate, the table of contents is ready; satisfactory: publications based on theses are appropriate, theses are formulated; pass: publications based on theses are appropriate.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (1)**				
2. Subject name in Hungarian	Disszertáció készítése (1)			**3. Role**	Mandatory
4. Code	**BMEKOGGD171**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Formulation of the main theses of the doctoral research, preparation of the draft of the dissertation.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: Theses and publications are organized together, the table of content is ready; good: the theses have been formulated, publications based on theses are appropriate, the table of contents is ready; satisfactory: publications based on theses are appropriate, theses are formulated; pass: publications based on theses are appropriate.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (1)**				
2. Subject name in Hungarian	Disszertáció készítése (1)			**3. Role**	Mandatory
4. Code	**BMEKOJSD171**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Formulation of the main theses of the doctoral research, preparation of the draft of the dissertation.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: Theses and publications are organized together, the table of content is ready; good: the theses have been formulated, publications based on theses are appropriate, the table of contents is ready; satisfactory: publications based on theses are appropriate, theses are formulated; pass: publications based on theses are appropriate.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (1)**				
2. Subject name in Hungarian	Disszertáció készítése (1)			**3. Role**	Mandatory
4. Code	**BMEKOKAD171**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Formulation of the main theses of the doctoral research, preparation of the draft of the dissertation.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: Theses and publications are organized together, the table of content is ready; good: the theses have been formulated, publications based on theses are appropriate, the table of contents is ready; satisfactory: publications based on theses are appropriate, theses are formulated; pass: publications based on theses are appropriate.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (1)**				
2. Subject name in Hungarian	Disszertáció készítése (1)			**3. Role**	Mandatory
4. Code	**BMEKOKKD171**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Formulation of the main theses of the doctoral research, preparation of the draft of the dissertation.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: Theses and publications are organized together, the table of content is ready; good: the theses have been formulated, publications based on theses are appropriate, the table of contents is ready; satisfactory: publications based on theses are appropriate, theses are formulated; pass: publications based on theses are appropriate.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (1)**				
2. Subject name in Hungarian	Disszertáció készítése (1)			**3. Role**	Mandatory
4. Code	**BMEKOVRD171**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Formulation of the main theses of the doctoral research, preparation of the draft of the dissertation.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: Theses and publications are organized together, the table of content is ready; good: the theses have been formulated, publications based on theses are appropriate, the table of contents is ready; satisfactory: publications based on theses are appropriate, theses are formulated; pass: publications based on theses are appropriate.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (2)**				
2. Subject name in Hungarian	Disszertáció készítése (2)			**3. Role**	Mandatory
4. Code	**BMEKOALD172**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Dissertation writing (1) (BMEKOALD171), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Preparing a doctoral thesis for the internal defense.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (2)**				
2. Subject name in Hungarian	Disszertáció készítése (2)			**3. Role**	Mandatory
4. Code	**BMEKOGGD172**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Dissertation writing (1) (BMEKOGGD171), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Preparing a doctoral thesis for the internal defense.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (2)**				
2. Subject name in Hungarian	Disszertáció készítése (2)			**3. Role**	Mandatory
4. Code	**BMEKOJSD172**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	Dissertation writing (1) (BMEKOJSD171), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Preparing a doctoral thesis for the internal defense.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (2)**				
2. Subject name in Hungarian	Disszertáció készítése (2)			**3. Role**	Mandatory
4. Code	**BMEKOKAD172**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	Dissertation writing (1) (BMEKOKAD171), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Preparing a doctoral thesis for the internal defense.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (2)**				
2. Subject name in Hungarian	Disszertáció készítése (2)			**3. Role**	Mandatory
4. Code	**BMEKOKKD172**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	Dissertation writing (1) (BMEKOKKD171), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Preparing a doctoral thesis for the internal defense.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (2)**				
2. Subject name in Hungarian	Disszertáció készítése (2)			**3. Role**	Mandatory
4. Code	**BMEKOVRD172**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	Dissertation writing (1) (BMEKOVRD171), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Preparing a doctoral thesis for the internal defense.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (3)**				
2. Subject name in Hungarian	Disszertáció készítése (3)			**3. Role**	Mandatory
4. Code	**BMEKOALD173**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Dissertation writing (2) (BMEKOALD172), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Preparing a doctoral thesis for public defense.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (3)**				
2. Subject name in Hungarian	Disszertáció készítése (3)			**3. Role**	Mandatory
4. Code	**BMEKOGGD173**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Dissertation writing (2) (BMEKOGGD172), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Preparing a doctoral thesis for public defense.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (3)**				
2. Subject name in Hungarian	Disszertáció készítése (3)			**3. Role**	Mandatory
4. Code	**BMEKOJSD173**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	Dissertation writing (2) (BMEKOJSD172), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Preparing a doctoral thesis for public defense.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (3)**				
2. Subject name in Hungarian	Disszertáció készítése (3)			**3. Role**	Mandatory
4. Code	**BMEKOKAD173**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	Dissertation writing (2) (BMEKOKAD172), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Preparing a doctoral thesis for public defense.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (3)**				
2. Subject name in Hungarian	Disszertáció készítése (3)			**3. Role**	Mandatory
4. Code	**BMEKOKKD173**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	Dissertation writing (2) (BMEKOKKD172), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Preparing a doctoral thesis for public defense.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Dissertation writing (3)**				
2. Subject name in Hungarian	Disszertáció készítése (3)			**3. Role**	Mandatory
4. Code	**BMEKOVRD173**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	Dissertation writing (2) (BMEKOVRD172), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Preparing a doctoral thesis for public defense.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to document, organize and present research results with scientific excellence.

18. Requirements, way to determine a grade (obtain a signature)

The student's supervisor evaluates his / her half-year performance with a midterm grade. Excellent: ready-made presentation, finished Hungarian and English thesis booklet, finished dissertation; good: ready-made presentation, finished Hungarian thesis book, finished dissertation; satisfactory: ready-made presentation, finished dissertation; pass: finished dissertation.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Publication activity (1)**				
2. Subject name in Hungarian	Publikációs tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKODHD161**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Fulfillment of the expected publication performance level of the entire scientific life-work related to the doctoral research.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to judge the publication capability of the research results and search for a suitable publication platform, and can compile the publication according to the publication requirements.

18. Requirements, way to determine a grade (obtain a signature)

Half of the submitted but pending publications can be counted, except for the WoS IF articles, they are only counted on the accepted article!

Based on the MTA MTO publication point system, at least 0.3 (0.6 for the modified system) score: 5 (excellent)

Based on the MTA MTO publication point system, at least 0.2 (0.4 - in the case of a modified system) score: 4 (goog)

Based on the MTA MTO publication point system, at least 0.1 (0.2 - for a modified system) score: 3 (satisfactory)

Based on the MTA MTO publication point system, at least 0.05 (0.1 for a modified system) score: 2 (good)

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Publication activity (2)**				
2. Subject name in Hungarian	Publikációs tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKODHD162**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Publication activity (1) (BMEKODHD161), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Fulfillment of the expected publication performance level of the entire scientific life-work related to the doctoral research.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to judge the publication capability of the research results and search for a suitable publication platform, and can compile the publication according to the publication requirements.

18. Requirements, way to determine a grade (obtain a signature)

Half of the submitted but pending publications can be counted, except for the WoS IF articles, they are only counted on the accepted article!

Based on the MTA MTO publication point system, at least 0.3 (0.6 for the modified system) score: 5 (excellent)

Based on the MTA MTO publication point system, at least 0.2 (0.4 - in the case of a modified system) score: 4 (goog)

Based on the MTA MTO publication point system, at least 0.1 (0.2 - for a modified system) score: 3 (satisfactory)

Based on the MTA MTO publication point system, at least 0.05 (0.1 for a modified system) score: 2 (good)

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Publication activity (3)**				
2. Subject name in Hungarian	Publikációs tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKODHD163**	**5. Evaluation type**	**m**	**6. Credits**	**26**
7. Weekly contact hours	**0 lecture**	**26 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**780 hours**
Contact hours	364 hours	**Preparation for seminars**	416 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Publication activity (2) (BMEKODHD162), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Fulfillment of the expected publication performance level of the entire scientific life-work related to the doctoral research.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to judge the publication capability of the research results and search for a suitable publication platform, and can compile the publication according to the publication requirements.

18. Requirements, way to determine a grade (obtain a signature)

Half of the submitted but pending publications can be counted, except for the WoS IF articles, they are only counted on the accepted article!

Based on the MTA MTO publication point system, at least 0.3 (0.6 for the modified system) score: 5 (excellent)

Based on the MTA MTO publication point system, at least 0.2 (0.4 - in the case of a modified system) score: 4 (goog)

Based on the MTA MTO publication point system, at least 0.1 (0.2 - for a modified system) score: 3 (satisfactory)

Based on the MTA MTO publication point system, at least 0.05 (0.1 for a modified system) score: 2 (good)

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Publication activity (4)**				
2. Subject name in Hungarian	Publikációs tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKODHD164**	**5. Evaluation type**	**m**	**6. Credits**	**20**
7. Weekly contact hours	**0 lecture**	**20 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**600 hours**
Contact hours	280 hours	**Preparation for seminars**	320 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Publication activity (3) (BMEKODHD163), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Fulfillment of the expected publication performance level of the entire scientific life-work related to the doctoral research.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to judge the publication capability of the research results and search for a suitable publication platform, and can compile the publication according to the publication requirements.

18. Requirements, way to determine a grade (obtain a signature)

Half of the submitted but pending publications can be counted, except for the WoS IF articles, they are only counted on the accepted article!

Based on the MTA MTO publication point system, at least 0.3 (0.6 for the modified system) score: 5 (excellent)

Based on the MTA MTO publication point system, at least 0.2 (0.4 - in the case of a modified system) score: 4 (goog)

Based on the MTA MTO publication point system, at least 0.1 (0.2 - for a modified system) score: 3 (satisfactory)

Based on the MTA MTO publication point system, at least 0.05 (0.1 for a modified system) score: 2 (good)

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Publication activity (5)**				
2. Subject name in Hungarian	Publikációs tevékenység (5)			**3. Role**	Mandatory
4. Code	**BMEKODHD165**	**5. Evaluation type**	**m**	**6. Credits**	**20**
7. Weekly contact hours	**0 lecture**	**20 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**600 hours**
Contact hours	280 hours	**Preparation for seminars**	320 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Publication activity (4) (BMEKODHD164), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Fulfillment of the expected publication performance level of the entire scientific life-work related to the doctoral research.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to judge the publication capability of the research results and search for a suitable publication platform, and can compile the publication according to the publication requirements.

18. Requirements, way to determine a grade (obtain a signature)

Half of the submitted but pending publications can be counted, except for the WoS IF articles, they are only counted on the accepted article!

Based on the MTA MTO publication point system, at least 0.3 (0.6 for the modified system) score: 5 (excellent)

Based on the MTA MTO publication point system, at least 0.2 (0.4 - in the case of a modified system) score: 4 (goog)

Based on the MTA MTO publication point system, at least 0.1 (0.2 - for a modified system) score: 3 (satisfactory)

Based on the MTA MTO publication point system, at least 0.05 (0.1 for a modified system) score: 2 (good)

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (1)**				
2. Subject name in Hungarian	Oktatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOALD131**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (1)**				
2. Subject name in Hungarian	Oktatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOGGD131**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (1)**				
2. Subject name in Hungarian	Oktatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOJSD131**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (1)**				
2. Subject name in Hungarian	Oktatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOKAD131**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (1)**				
2. Subject name in Hungarian	Oktatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOKKD131**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (1)**				
2. Subject name in Hungarian	Oktatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOVRD131**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (2)**				
2. Subject name in Hungarian	Oktatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOALD132**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Teaching activity (1) (BMEKOALD131), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (2)**				
2. Subject name in Hungarian	Oktatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOGGD132**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Teaching activity (1) (BMEKOGGD131), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (2)**				
2. Subject name in Hungarian	Oktatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOJSD132**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	Teaching activity (1) (BMEKOJSD131), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (2)**				
2. Subject name in Hungarian	Oktatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOKAD132**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	Teaching activity (1) (BMEKOKAD131), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (2)**				
2. Subject name in Hungarian	Oktatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOKKD132**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	Teaching activity (1) (BMEKOKKD131), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (2)**				
2. Subject name in Hungarian	Oktatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOVRD132**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	Teaching activity (1) (BMEKOVRD131), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (3)**				
2. Subject name in Hungarian	Oktatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOALD133**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Teaching activity (2) (BMEKOALD132), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (3)**				
2. Subject name in Hungarian	Oktatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOGGD133**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Teaching activity (2) (BMEKOGGD132), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (3)**				
2. Subject name in Hungarian	Oktatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOJSD133**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	Teaching activity (2) (BMEKOJSD132), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature), opportunity for repeat/retake and delayed completion

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.
The semester requirements cannot be delayed completed or improved.

19. Learning materials

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Teaching activity (3)**				
2. Subject name in Hungarian	Oktatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOKAD133**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	Teaching activity (2) (BMEKOKAD132), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature), opportunity for repeat/retake and delayed completion

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

The semester requirements cannot be delayed completed or improved.

19. Learning materials

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Teaching activity (3)**				
2. Subject name in Hungarian	Oktatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOKKD133**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	Teaching activity (2) (BMEKOKKD132), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (3)**				
2. Subject name in Hungarian	Oktatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOVRD133**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	Teaching activity (2) (BMEKOVRD132), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (4)**				
2. Subject name in Hungarian	Oktatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOALD134**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Teaching activity (3) (BMEKOALD133), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (4)**				
2. Subject name in Hungarian	Oktatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOGGD134**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Teaching activity (3) (BMEKOGGD133), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (4)**				
2. Subject name in Hungarian	Oktatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOJSD134**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	Teaching activity (3) (BMEKOJSD133), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (4)**				
2. Subject name in Hungarian	Oktatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOKAD134**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	Teaching activity (3) (BMEKOKAD133), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (4)**				
2. Subject name in Hungarian	Oktatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOKKD134**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	Teaching activity (3) (BMEKOKKD133), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (4)**				
2. Subject name in Hungarian	Oktatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOVRD134**	**5. Evaluation type**	**m**	**6. Credits**	**6**
7. Weekly contact hours	**0 lecture**	**6 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**180 hours**
Contact hours	84 hours	**Preparation for seminars**	96 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	Teaching activity (3) (BMEKOVRD133), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (5)**				
2. Subject name in Hungarian	Oktatási tevékenység (5)			**3. Role**	Mandatory
4. Code	**BMEKOALD135**	**5. Evaluation type**	**m**	**6. Credits**	**4**
7. Weekly contact hours	**0 lecture**	**4 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	64 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Teaching activity (4) (BMEKOALD134), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (5)**				
2. Subject name in Hungarian	Oktatási tevékenység (5)			**3. Role**	Mandatory
4. Code	**BMEKOGGD135**	**5. Evaluation type**	**m**	**6. Credits**	**4**
7. Weekly contact hours	**0 lecture**	**4 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	64 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Teaching activity (4) (BMEKOGGD134), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (5)**				
2. Subject name in Hungarian	Oktatási tevékenység (5)			**3. Role**	Mandatory
4. Code	**BMEKOJSD135**	**5. Evaluation type**	**m**	**6. Credits**	**4**
7. Weekly contact hours	**0 lecture**	**4 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	64 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	Teaching activity (4) (BMEKOJSD134), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (5)**				
2. Subject name in Hungarian	Oktatási tevékenység (5)			**3. Role**	Mandatory
4. Code	**BMEKOKAD135**	**5. Evaluation type**	**m**	**6. Credits**	**4**
7. Weekly contact hours	**0 lecture**	**4 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	64 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	Teaching activity (4) (BMEKOKAD134), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Teaching activity (5)**				
2. Subject name in Hungarian	Oktatási tevékenység (5)			**3. Role**	Mandatory
4. Code	**BMEKOKKD135**	**5. Evaluation type**	**m**	**6. Credits**	**4**
7. Weekly contact hours	**0 lecture**	**4 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	64 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	Teaching activity (4) (BMEKOKKD134), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Teaching activity (5)**				
2. Subject name in Hungarian	Oktatási tevékenység (5)			**3. Role**	Mandatory
4. Code	**BMEKOVRD135**	**5. Evaluation type**	**m**	**6. Credits**	**4**
7. Weekly contact hours	**0 lecture**	**4 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**120 hours**
Contact hours	56 hours	**Preparation for seminars**	64 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	Teaching activity (4) (BMEKOVRD134), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Holding practical classes and laboratory practices, supervising and evaluating midterm exams and written exams, consulting and evaluating lab tasks and other home assignements, contributing to lectures.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- Through participating in the teaching activitiy of the department, both the student's lecturer skills and educational methodological experiences will develop.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester education activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Research progress report (1)**				
2. Subject name in Hungarian	Kutatási előrehaladási jelentés (1)			**3. Role**	Mandatory
4. Code	**BMEKODHD141**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Demonstration of the scientific results of the given period of the doctoral research and of all previous results.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student will be able to assess the progress of its research according to the general research plan, document the progress and adjust the previously defined research plan.

18. Requirements, way to determine a grade (obtain a signature)

The vice dean for scientific affairs evaluates the fulfillment of the reporting obligation set out in the Regulations of the Doctoral School by giving midterm grade.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Research progress report (2)**				
2. Subject name in Hungarian	Kutatási előrehaladási jelentés (2)			**3. Role**	Mandatory
4. Code	**BMEKODHD142**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Research progress report (1) (BMEKODHD141), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Demonstration of the scientific results of the given period of the doctoral research and of all previous results.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student will be able to assess the progress of its research according to the general research plan, document the progress and adjust the previously defined research plan.

18. Requirements, way to determine a grade (obtain a signature)

The vice dean for scientific affairs evaluates the fulfillment of the reporting obligation set out in the Regulations of the Doctoral School by giving midterm grade.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

19. Learning materials

-

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

Subject description

1. Subject name	**Research progress report (3)**				
2. Subject name in Hungarian	Kutatási előrehaladási jelentés (3)			**3. Role**	Mandatory
4. Code	**BMEKODHD143**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Research progress report (2) (BMEKODHD142), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Demonstration of the scientific results of the given period of the doctoral research and of all previous results.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student will be able to assess the progress of its research according to the general research plan, document the progress and adjust the previously defined research plan.

18. Requirements, way to determine a grade (obtain a signature)

The vice dean for scientific affairs evaluates the fulfillment of the reporting obligation set out in the Regulations of the Doctoral School by giving midterm grade.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Research progress report (4)**				
2. Subject name in Hungarian	Kutatási előrehaladási jelentés (4)			**3. Role**	Mandatory
4. Code	**BMEKODHD144**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Research progress report (3) (BMEKODHD143), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Demonstration of the scientific results of the given period of the doctoral research and of all previous results.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student will be able to assess the progress of its research according to the general research plan, document the progress and adjust the previously defined research plan.

18. Requirements, way to determine a grade (obtain a signature)

The vice dean for scientific affairs evaluates the fulfillment of the reporting obligation set out in the Regulations of the Doctoral School by giving midterm grade.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Research progress report (5)**				
2. Subject name in Hungarian	Kutatási előrehaladási jelentés (5)			**3. Role**	Mandatory
4. Code	**BMEKODHD145**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Research progress report (4) (BMEKODHD144), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Demonstration of the scientific results of the given period of the doctoral research and of all previous results.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student will be able to assess the progress of its research according to the general research plan, document the progress and adjust the previously defined research plan.

18. Requirements, way to determine a grade (obtain a signature)

The vice dean for scientific affairs evaluates the fulfillment of the reporting obligation set out in the Regulations of the Doctoral School by giving midterm grade.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Research progress report (6)**				
2. Subject name in Hungarian	Kutatási előrehaladási jelentés (6)			**3. Role**	Mandatory
4. Code	**BMEKODHD146**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Research progress report (5) (BMEKODHD145), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Demonstration of the scientific results of the given period of the doctoral research and of all previous results.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student will be able to assess the progress of its research according to the general research plan, document the progress and adjust the previously defined research plan.

18. Requirements, way to determine a grade (obtain a signature)

The vice dean for scientific affairs evaluates the fulfillment of the reporting obligation set out in the Regulations of the Doctoral School by giving midterm grade.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Research progress report (7)**				
2. Subject name in Hungarian	Kutatási előrehaladási jelentés (7)			**3. Role**	Mandatory
4. Code	**BMEKODHD147**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Research progress report (6) (BMEKODHD146), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Demonstration of the scientific results of the given period of the doctoral research and of all previous results.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student will be able to assess the progress of its research according to the general research plan, document the progress and adjust the previously defined research plan.

18. Requirements, way to determine a grade (obtain a signature)

The vice dean for scientific affairs evaluates the fulfillment of the reporting obligation set out in the Regulations of the Doctoral School by giving midterm grade.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Research progress report (8)**				
2. Subject name in Hungarian	Kutatási előrehaladási jelentés (8)			**3. Role**	Mandatory
4. Code	**BMEKODHD148**	**5. Evaluation type**	**m**	**6. Credits**	**5**
7. Weekly contact hours	**0 lecture**	**5 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**150 hours**
Contact hours	70 hours	**Preparation for seminars**	80 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Dean's Office
11. Responsible lecturer	Dr. Török Ádám
12. Lecturers	Dr. Török Ádám

13. Prerequisites	Research progress report (7) (BMEKODHD147), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Demonstration of the scientific results of the given period of the doctoral research and of all previous results.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student will be able to assess the progress of its research according to the general research plan, document the progress and adjust the previously defined research plan.

18. Requirements, way to determine a grade (obtain a signature)

The vice dean for scientific affairs evaluates the fulfillment of the reporting obligation set out in the Regulations of the Doctoral School by giving midterm grade.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Individual resarch activity (1)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOALD151**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (1)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOGGD151**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (1)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOJSD151**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (1)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOKAD151**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (1)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOKKD151**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (1)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (1)			**3. Role**	Mandatory
4. Code	**BMEKOVRD151**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	- (-), -; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (2)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOALD152**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Individual resarch activity (1) (BMEKOALD151), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Individual resarch activity (2)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOGGD152**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Individual resarch activity (1) (BMEKOGGD151), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Individual resarch activity (2)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOJSD152**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	Individual resarch activity (1) (BMEKOJSD151), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (2)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOKAD152**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	Individual resarch activity (1) (BMEKOKAD151), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (2)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOKKD152**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	Individual resarch activity (1) (BMEKOKKD151), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Individual resarch activity (2)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (2)			**3. Role**	Mandatory
4. Code	**BMEKOVRD152**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	Individual resarch activity (1) (BMEKOVRD151), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Individual resarch activity (3)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOALD153**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Individual resarch activity (2) (BMEKOALD152), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Individual resarch activity (3)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOGGD153**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Individual resarch activity (2) (BMEKOGGD152), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Individual resarch activity (3)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOJSD153**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	Individual resarch activity (2) (BMEKOJSD152), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (3)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOKAD153**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	Individual resarch activity (2) (BMEKOKAD152), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

-

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

Subject description

1. Subject name	**Individual resarch activity (3)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOKKD153**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	Individual resarch activity (2) (BMEKOKKD152), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (3)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (3)			**3. Role**	Mandatory
4. Code	**BMEKOVRD153**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	Individual resarch activity (2) (BMEKOVRD152), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

-

17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (4)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOALD154**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Material Handling and Logistics Systems
11. Responsible lecturer	Dr. Bóna Krisztián
12. Lecturers	Dr. Bóna Krisztián

13. Prerequisites	Individual resarch activity (3) (BMEKOALD153), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (4)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOGGD154**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Automotive Technologies
11. Responsible lecturer	Dr. Szalay Zsolt
12. Lecturers	Dr. Szalay Zsolt

13. Prerequisites	Individual resarch activity (3) (BMEKOGGD153), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (4)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOJSD154**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Vehicle Elements and Vehicle-Structure Analysis
11. Responsible lecturer	Dr. Lovas László
12. Lecturers	Dr. Lovas László

13. Prerequisites	Individual resarch activity (3) (BMEKOJSD153), strong; - (-), -; - (-), -

14. Description of lectures

-

15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (4)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOKAD154**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Control for Transportation and Vehicle Systems
11. Responsible lecturer	Dr. Gáspár Péter
12. Lecturers	Dr. Gáspár Péter

13. Prerequisites	Individual resarch activity (3) (BMEKOKAD153), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (4)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOKKD154**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Transport Technology and Economics
11. Responsible lecturer	Dr. Tóth János
12. Lecturers	Dr. Tóth János

13. Prerequisites	Individual resarch activity (3) (BMEKOKKD153), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

- The student is able to implement the ideas formulated in the semester research plan, evaluate and document the results.

18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

The semester requirements cannot be delayed completed or improved.

20. Learning materials

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

Subject description

1. Subject name	**Individual resarch activity (4)**				
2. Subject name in Hungarian	Önálló kutatási tevékenység (4)			**3. Role**	Mandatory
4. Code	**BMEKOVRD154**	**5. Evaluation type**	**m**	**6. Credits**	**10**
7. Weekly contact hours	**0 lecture**	**10 practice**	**0 lab**	**8. Curriculum**	**D**

9. Working hours for fulfilling the requirements of the subject					**300 hours**
Contact hours	140 hours	**Preparation for seminars**	160 hours	**Homework**	0 hours
Reading written materials	0 hours	**Midterm preparation**	0 hours	**Exam preparation**	0 hours

10. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
11. Responsible lecturer	Dr. Rohács Dániel
12. Lecturers	Dr. Rohács Dániel

13. Prerequisites	Individual resarch activity (3) (BMEKOVRD153), strong; - (-), -; - (-), -

14. Description of lectures

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15. Description of practices

Semester research activity agreed with the supervisor.

16. Description of laboratory practices

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17. Learning outcomes

a) Knowledge and Ability:

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18. Requirements, way to determine a grade (obtain a signature)

The supervisor evaluates the student's semester research activity with midterm grade in the light of preliminary plans.

19. Retake and delayed completion

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