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

Course description

1. Subject name	Advanced CFD in Vehicle Industry				
2. Code	BMEKORHD 005	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	2 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

The state of the art introduction of the different simulation techniques in the field of CFD with especial care for vehicle applications as follows: internal and external flows in automotive engineering, aerodynamics of air- and spacecraft, turbomachinery (compressors, turbines and propellers), modelling of burning in gas turbine combustors, particle tracking, flows in porous materials, free surface flows, aeroacoustics and optimizations.

14. Individual student assignment

Solution of a defined problem in a specific area.

15. Assessment, requirements for examination

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.

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

Course description

1. Subject name	Analitical Methots in System Technique I.				
2. Code	BMEKOVJD 001	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject				-	
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

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.

14. Individual student assignment

Solution of a homework using mathematical methods. Individual programming tasks using equations of the theoretical part of the coures.

15. Assessment, requirements for examination

Accepted homework sent before the deadline and written exam.

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

Course description

1. Subject name	Analitical Methots in System Technique II.				
2. Code	**BMEKOVJD 002**	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	Analitikus módszerek a rendszertechnikában I.

13. Objective of the subject

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.

14. Individual student assignment

Practical tasks for using theory.

15. Assessment, requirements for examination

Regular participation at the lectures and written exam.

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

Course description

1. Subject name	Analitical Methots in System Technique III.				
2. Code	BMEKOVJD 003	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	Analitikus módszerek a rendszertechnikában I. és II.

13. Objective of the subject

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

14. Individual student assignment

Practical tasks for using theory.

15. Assessment, requirements for examination

Regular participation at the lectures and written exam.

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

Course description

1. Subject name	Analytical mechanics				
2. Code	BMEKOJSD 001	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	1 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Presentation of basic notions and study methods of the analytical mechanics. Theoretical background for those PhD students who need to define equations of motion and to study them analytically .

14. Individual student assignment

Preparation of an essay or paper in the topic of the PhD student, based on the discussed methods. Review and evaluation by the teacher.

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Continuum Mechanics				
2. Code	**BMEKOMED 030**	**3. Evaluation**	exam	**4. Credit**	**4**
5. Seminars per week	**2 lecture**	**1 practice**	**0 lab**	**6. Curriculum**	**D0, D1**

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	**Preparation for seminars**	-	**Homework**	-
Reading written syllabus	-	**Exam preparation**	-	**Final exam preparation**	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Presentation of basic notions and study methods of the continuum mechanics. Theoretical background for students that need to study motion and deformation of material bodies considered as continuum.

14. Individual student assignment

Preparation of an essay or paper in the topic of the PhD student, based on the discussed methods. Review and evaluation by the teacher.

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Data collection and evaluation systems PhD				
2. Code	BMEKOGED 007	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	2 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Role of the measurements in the modern structure design process. Presentation of the measurement theory and process for photoelastic coatings and for strain measurement.

14. Individual student assignment

Preparation of an essay based on the discussed methods. Oral presentation.

15. Assessment, requirements for examination

Semester note upon the essay, the presentation and a written exam.

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

Course description

1. Subject name	Digital Image Processing				
2. Code	**BMEKOALD 002**	**3. Evaluation**	**exam**	**4. Credit**	**4**
5. Seminars per week	**2 lecture**	**0 practice**	**2 lab**	**6. Curriculum**	**D0, D1**

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Digital image processing deals with processing of 2 and 3 dimensional structures of digital images, including enhancement, reconstruction and analysis.

Students study the theoretical background of image interpretation and analysis, including basis of pattern recognition.

14. Individual student assignment

Realization and testing of algorithms.

15. Assessment, requirements for examination

The grade is calculated from the grade of the two mid-term tests, and the grade of the final exam as an average.

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

Course description

1. Subject name	Electronically controlled vehicle systems PhD				
2. Code	BMEKOGJD 003	3. Evaluation	exam	4. Credit	4
5. Seminars per week	4 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Vehicle Technology
9. Responsible lecturer	Dr. Szalay Zsolt
10. Lecturers	Dr. Tihanyi Viktor

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

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.

14. Individual student assignment

Attendees of the subject - based on the presentations and research work related to the subject, - make out the dynamic model of an arbitrarily selected, electronically controlled vehicle system, and examine its stability problems.

15. Assessment, requirements for examination

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.

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

Course description

1. Subject name	Financing Transport Infrastructure				
2. Code	**BMEKOKKD 007**	3. Evaluation	**exam**	4. Credit	**4**
5. Seminars per week	**4 lecture**	**0 practice**	**0 lab**	6. Curriculum	**D0, D1**

7. Needed working hours for achieving the requirements of the subject					**-**
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	**Department of Transport Technology and Economics**
9. Responsible lecturer	Dr. Békefi Zoltán
10. Lecturers	Dr. Békefi Zoltán

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Presentation of theoretical base of transport infrastructure financing. Ffinancing principles, methods and procedures. Development of skills for practical applications.

14. Individual student assignment

Preparing a presentation of a transport infrastructure project, making a financial and economical efficiency analysis based on the methodology introduced on the lectures and computer labs.

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Functionalanalysis for Engineers				
2. Code	**BMEKOVJD 018**	3. Evaluation	**exam**	4. Credit	**4**
5. Seminars per week	**2 lecture**	**0 practice**	**0 lab**	6. Curriculum	**D0, D1**

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	**Department of Aeronautics, Naval Architecture and Railway Vehicles**
9. Responsible lecturer	Dr. Zobory István
10. Lecturers	Dr. Zobory István

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

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.

14. Individual student assignment

Practical tasks for using theory.

15. Assessment, requirements for examination

Regular participation at the lectures and written exam.

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

Course description

1. Subject name	Informatics in Logistics (PhD)				
2. Code	BMEKOKUD 014	3. Evaluation	exam	4. Credit	4
5. Seminars per week	4 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Material Handling and Logistics Systems
9. Responsible lecturer	Dr. Kovács Gábor
10. Lecturers	Dr. Kovács Gábor

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

The subject gives advanced knowledge of information technology in logistics systems, including data modelling, computer networks and enterprise resource planning systems.

14. Individual student assignment

A semi-annual task, which is connected to the research task of PhD student. Summary of the research in a scientific paper.

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Materials Science				
2. Code	BMEKOGGD 001	3. Evaluation	exam	4. Credit	4
5. Seminars per week	4 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Vehicle Technology
9. Responsible lecturer	Dr. Bán Krisztián
10. Lecturers	Dr. Bán Krisztián

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Providing high-quality knowledge of structural materials (metals, alloys, plastics, ceramics and composites), from those production, processing and recycling, covering the entire life cycle of materials, concerning global problems of environmental pollution and sustainable development, and state of the art material testing methods.

14. Individual student assignment

The basis of reading course is examination of hungarian and international literature in topics agreed individually.

15. Assessment, requirements for examination

The course ends with an oral examination.

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

Course description

1. Subject name	Mathematical methods I.				
2. Code	**BMEKOKAD 003**	**3. Evaluation**	**exam**	**4. Credit**	**4**
5. Seminars per week	**2 lecture**	**0 practice**	**0 lab**	**6. Curriculum**	**D0, D1**

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	**Preparation for seminars**	-	**Homework**	-
Reading written syllabus	-	**Exam preparation**	-	**Final exam preparation**	-

8. Department	**Department of Control for Transportation and Vehicle Systems**
9. Responsible lecturer	Dr. Péter Tamás
10. Lecturers	Dr. Péter Tamás

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

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.

14. Individual student assignment

Writing a paper using mathematical methods in the field of the student. The paper will be evaluated by the lecturer.

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Mathematical methods II.				
2. Code	BMEKOKAD 007	3. Evaluation	exam	4. Credit	4
5. Seminars per week	1 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

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.

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

14. Individual student assignment

Writing a paper using mathematical methods in the field of the student. The paper will be evaluated by the lecturer.

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Mechanics of plastic deformations				
2. Code	BMEKOJSD 002	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	1 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Presentation of basic notions and study methods of the plastic deformations. Theoretical background for those PhD students who need to study plastic deformations.

14. Individual student assignment

Preparation of an essay or paper in the topic of the PhD student, based on the discussed methods. Review and evaluation by the teacher.

15. Assessment, requirements for examination

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

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

1. Subject name	Modern control theory II.				
2. Code	BMEKOKAD 002	3. Evaluation	exam	4. Credit	5
5. Seminars per week	4 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Control for Transportation and Vehicle Systems
9. Responsible lecturer	Dr. Bokor József
10. Lecturers	Dr. Bokor József Dr. Szabó Zoltán

11. Mandatory requirement	-
12. Recommended requirements	Szabályozástechnika, lineáris algebra alapjai

13. Objective of the subject

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.

14. Individual student assignment

Students should solve a dedicated robust analysis and design example related to a vehicle dynamics application.

15. Assessment, requirements for examination

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.

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

Course description

1. Subject name	Nonlinear mechanical oscillations				
2. Code	BMEKOJSD 003	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	1 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Presentation of basic notions and study methods of nonlinear theory of oscillations. Theoretical background for those PhD students who need to study motion of nonlinear mechanical systems.

14. Individual student assignment

Preparation of an essay or paper in the topic of the PhD student, based on the discussed methods. Review and evaluation by the teacher.

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Operational Research in Logistics				
2. Code	BMEKOALD 001	3. Evaluation	exam	4. Credit	4
5. Seminars per week	4 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Material Handling and Logistics Systems
9. Responsible lecturer	Dr. Bóna Krisztián
10. Lecturers	Dr. Bóna Krisztián

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

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).

14. Individual student assignment

Creating a case study with developing a mathematical model, in connection to the PhD student's scientific research. Summarizing of the results in a scientific white paper.

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Processes of Vehicle Production				
2. Code	BMEKOGGD 003	3. Evaluation	exam	4. Credit	4
5. Seminars per week	4 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Vehicle Technology
9. Responsible lecturer	Dr. Markovits Tamás
10. Lecturers	Dr. Markovits Tamás

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Objective of the subject is to give high level knowledge of technologies using in manufacturing and repearing of vehicles. The place of installation technologies in the manufacturing process. Specific joint and welding technologies using in vehicle manufacturing.

14. Individual student assignment

Independent research of literature and creation of document is necessery from the determined topic.

15. Assessment, requirements for examination

The course ends with an oral examination.

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

Course description

1. Subject name	Processes of Vehicle Production				
2. Code	BMEKOGTD 013	3. Evaluation	exam	4. Credit	4
5. Seminars per week	4 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Vehicle Technology
9. Responsible lecturer	Dr. Vehovszky Balázs
10. Lecturers	Dr. Vehovszky Balázs

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Giving high-level theoretical knowledge of processes of forming, manufacturing and repairing of vehicles and those parts, as well as of surface properties transforming processes, cutting and fine surface finishing technologies.

14. Individual student assignment

-

15. Assessment, requirements for examination

The course ends with an oral examination.

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

Course description

1. Subject name	Simulation systems and software				
2. Code	**BMEKOEAD 011**	3. Evaluation	exam	4. Credit	4
5. Seminars per week	**4 lecture**	**0 practice**	**0 lab**	6. Curriculum	**D0, D1**

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	**Department of Material Handling and Logistics Systems**
9. Responsible lecturer	Dr. Bohács Gábor
10. Lecturers	Dr. Bohács Gábor

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

The subject aims to give an overview for the students on advanced simulation modelling technology for logistics. Main features of simulation software is discussed. During the classes basic features of system dynamics, discrete event simulation and agent based simulations are discussed as well. Typical application areas of simulations for industrial and scientific purposes also surveyed. Optimization methods are presented in details. During the semester the students write 2 tests and an individual essay.

14. Individual student assignment

Each student should write an essay on the solution of a simulation related problem. This essay is expected to be the basis of a scientific paper. The students need to create a simulation agent and test it into modelling environment.

15. Assessment, requirements for examination

The grade is calculated from the grade of the individual work and the two mid-term tests as an average.

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

Course description

1. Subject name	Stochasic Processes in System Dynamics I.				
2. Code	**BMEKOVJD 009**	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	Analitikus módszerek a rendszertechnikában I.

13. Objective of the subject

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.

14. Individual student assignment

Practical tasks for using theory.

15. Assessment, requirements for examination

Regular participation at the lectures and written exam.

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

Course description

1. Subject name	Stochasic Processes in System Dynamics II.				
2. Code	BMEKOVJD 010	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject				-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	Szochasztikus folyamatok a rendszerdinamikában I.

13. Objective of the subject

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 $L2(\square,A,P)$. 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.

14. Individual student assignment

Solution of a homework using mathematical methods. Individual programming tasks using equations of the theoretical part of the courese.

15. Assessment, requirements for examination

Accepted homework sent before the deadline and written exam.

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

Course description

1. Subject name	Stochasic Processes in System Dynamics III.				
2. Code	BMEKOVJD 011	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	Szochasztikus folyamatok a rendszerdinamikában I. és II.

13. Objective of the subject

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

14. Individual student assignment

Solution of a homework using mathematical methods. Individual programming tasks using equations of the theoretical part of the courese.

15. Assessment, requirements for examination

Accepted homework sent before the deadline and written exam.

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

Course description

1. Subject name	Transport Economics I (PhD)				
2. Code	BMEKOKGD 006	3. Evaluation	exam	4. Credit	4
5. Seminars per week	3 lecture	2 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Transport Technology and Economics
9. Responsible lecturer	Dr. Táczos Lászlóné, Dr. Török Ádám
10. Lecturers	Dr. Táczos Lászlóné, Dr. Török Ádám

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Transp.Eco.I.PhD

14. Individual student assignment

Individual student task is to modell and analyse a transport economic problem

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Transport Economics II (PhD)				
2. Code	BMEKOKGD 007	3. Evaluation	exam	4. Credit	4
5. Seminars per week	3 lecture	2 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Transport Technology and Economics
9. Responsible lecturer	Dr. Táczos Lászlóné, Dr. Török Ádám
10. Lecturers	Dr. Táczos Lászlóné, Dr. Török Ádám

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Transp. Eco.II.PhD

14. Individual student assignment

Individual student task is to modell and analyse a transport economic problem

15. Assessment, requirements for examination

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

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

Course description

1. Subject name	Vehicle Manufacturing Systems				
2. Code	**BMEKOGTD 014**	3. Evaluation	**exam**	4. Credit	**4**
5. Seminars per week	**4 lecture**	**0 practice**	**0 lab**	6. Curriculum	**D0, D1**

7. Needed working hours for achieving the requirements of the subject					**-**
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	**Department of Vehicle Technology**
9. Responsible lecturer	Dr. Takács János
10. Lecturers	Dr. Takács János

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

The aim of this subject to give research and development approach to design, build, and modernise manufacturing systems of vehicles and those parts.

14. Individual student assignment

-

15. Assessment, requirements for examination

The course ends with an oral examination.

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

Course description

1. Subject name	Vehicle Materials				
2. Code	BMEKOGGD 002	3. Evaluation	exam	4. Credit	4
5. Seminars per week	4 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Vehicle Technology
9. Responsible lecturer	Dr. Bán Krisztián
10. Lecturers	Dr. Bán Krisztián

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

Giving high-level theoretical knowledge of vehicles structural materials, manufacturing processes of vehicle parts, including plastic deformation processes, surface properties transforming processes and their machines.

14. Individual student assignment

The basis of reading course is examination of hungarian and international literature in topics agreed individually.

15. Assessment, requirements for examination

The course ends with an oral examination.

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

Course description

1. Subject name	Vehicle system dynamics I.				
2. Code	BMEKOVJD 007	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	-

13. Objective of the subject

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.

14. Individual student assignment

Practical tasks for using theory.

15. Assessment, requirements for examination

Regular participation at the lectures and written exam.

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

Course description

1. Subject name	Vehicle system dynamics II.				
2. Code	BMEKOVJD 008	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

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

11. Mandatory requirement	-
12. Recommended requirements	Járműrendszerdinamika I.

13. Objective of the subject

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.

14. Individual student assignment

Practical tasks for using theory.

15. Assessment, requirements for examination

Regular participation at the lectures and written exam.

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

Course description

1. Subject name	Vehicle system dynamics III.				
2. Code	BMEKOVJD 014	3. Evaluation	exam	4. Credit	4
5. Seminars per week	2 lecture	0 practice	0 lab	6. Curriculum	D0, D1

7. Needed working hours for achieving the requirements of the subject					-
Contact hours	-	Preparation for seminars	-	Homework	-
Reading written syllabus	-	Exam preparation	-	Final exam preparation	-

8. Department	Department of Aeronautics, Naval Architecture and Railway Vehicles
9. Responsible lecturer	Dr. Szabó András
10. Lecturers	Dr. Szabó András

11. Mandatory requirement	-
12. Recommended requirements	Járműrendszerdinamika II.

13. Objective of the subject

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.

14. Individual student assignment

Practical tasks for using theory.

15. Assessment, requirements for examination

Regular participation at the lectures and written exam.