The Faculty of Transportation Engineering and Vehicle Engineering is educating engineers since 1951 in fields of transportation and logistics processes, vehicle operation, planning, control and related complex technical requirements. The aim of the education is to qualify graduates, who will manage tasks in the fields of transport operation and management, enterprise logistics systems, supply-distribution network organization and manufacturing of industrial machines.

The Faculty of Transportation Engineering and Vehicle Engineering offers 3 BSc programmes.

- In the Transportation Engineering BSc we focus on transportation and shipping related processes and their control.
- Students will acquire knowledge on the transportation vehicles, machinery, material handling and building machinery in the Vehicle Engineering BSc programme.
- Meanwhile the Logistics Engineering BSc offers complex insight and knowledge in corporate logistics systems and supply chains and also helps with building up an analytical point of view.

The Faculty offers 3 MSc programmes:

- Vehicle Engineering MSc,
- Transportation Engineering MSc,
- Logistics Engineering MSc.

At the end of each programme the best graduates can take part in the PhD programme of the Faculty. The program is hosted by the Kandó Kálmán Doctoral School, which is one of the main sources for engineers in the fields of vehicle technology, transportation and logistics in the country.

Departments:

Department of Material Handling and Logistics Systems
Department of Automobiles and Vehicle Manufacturing
Department of Vehicle Elements and Vehicle Structure Analysis
Department of Control for Transportation and Vehicle Systems
Department of Transport Technology and Economics
Department of Aeronautics, Naval Architecture and Railway Vehicles

Budapest University of Technology and Economics
Faculty of Transportation Engineering and Vehicle Engineering
Faculty Office: Building K I. 27.
Address: H-1111 Budapest, Műegyetem rkp. 3.
E-mail: kjk@mail.bme.hu
Phone: +36-1-463-3551

Dean of the Faculty: Dr. István Varga
Vice-dean of the Faculty: Dr. Ádám Török
Program co-ordinator: Ms. Barbara Mag
Description of BSc training

BSc in Vehicle Engineering

**Length of study:** 7 semesters

**Program objectives:** The aim of the bachelor education programme is to train vehicle engineers, who will be able to maintain and operate road, railway, water, air, construction and material handling vehicles with appropriate knowledge in the fields of transportation and logistics. They will be able to fulfill roles of vehicle engineering tasks, like improvement, manufacturing and operation. The listed tasks are accomplished by taking into account safety, environment and energy management aspects. The gained knowledge provides the basics to continue their education in the MSc programmes of the Faculty.

**Specializations:** Automotive vehicle, Aerospace vehicle, Naval vehicle, Railway vehicle, Construction equipment, Automated material handling equipment and robotics, Vehicle manufacturing, Vehicle mechatronics, Vehicle structure

**Competencies and skills:** Possessing the basic certificate, the vehicle engineers - taking into consideration also the prospective specialisations - become able:

- to determine the necessary equipment for the realisation of transportation and logistic processes,
- to organize, arrange, control the safe, the powerful and environmental-protective operation of vehicles, vehicle systems, mobile machines, materials-handling machines and machine systems,
- to perform the basic engineering tasks related to the designing, manufacturing, repair, as well as organisation of vehicles and mobile-machinery,
- to provide and organize the official work related to installation and operation of vehicles and mobile-machinery.

BSc in Transportation Engineering

**Length of study:** 7 semesters

**Program objectives:** The aim of the bachelor engineering programme is to train transportation engineers, who will be able to organize and operate processes of passenger and goods transportation. They will learn how to choose proper measures for these tasks, how to operate and maintain such transportation systems, including elements of infrastructure, control and IT systems. The gained knowledge is sufficient to continue their education in the MSc programmes of the Faculty.

**Specializations:** Road transportation, Railway transportation, Air transportation, Waterborne transportation

**Competencies and skills:** The transportation engineers received a basic certificate (BSc) - taking into consideration also the specialisations - become able:

- to recognise the demands for transportation and transportation-logistics, to determine the relationships to be applied,
- to exert active detailed cognition of transportation-and transportation logistics processes, to manage the processes mentioned together with their technical realisation,
- to design processes in accordance with the function of transportation and transportation-logistics systems, to select the technical components and to manage the operation of the system,
- to keep in operation vehicles and mobile machines serving the transportation process, to make the control systems operated, to take into consideration the environmental factors,
- to perform designing, organising and keeping in operation duties,
- to carry out public service and marketing activities.
BSc in Logistics Engineering
Length of study: 7 semesters

Program objectives: The aim of the study is to train logistics engineers, who will be able to maintain and operate corporate logistics and good transportation systems. They will know modern supply chains and networks, their management and organizational basics, and transport control processes and workflows. Related logistics control and IT systems basics are also acquired. The gained knowledge is sufficient to continue their education in the MSc programmes of the Faculty.

Specializations: From the 5th semester every student will participate in one logistics engineer specialization, which covers all specific areas of logistics, and prepares the further MSc integration and specializations, and/or the specific logistics operating engineer work.

Competences and skills: Possessing the basic certificate, the logistics engineers - taking into consideration also the prospective specialisations - become able:

- to define the equipment necessary to realize logistics systems and processes,
- to organize, arrange, control logistics systems in a safe and environmentally-friendly way,
- to perform the basic engineering tasks related to the design, manufacture and repair, as well as the organization of material handling machines,
- to provide and organize the official work related to the installation and operation of logistics machinery.

Actually, due to changes in basic training (BSc) our Faculty can ensure training in English with tuition fee for the time being only part-time (attending term at other faculties, training exchange students). The list of optional subjects in the given term is on website: http://transportation.bme.hu/for-students/courses/

Description of MSc training

MSc in Vehicle Engineering
Length of study: 4 semesters

Program objectives: The 4 semester long master education programme is a continuation of the bachelor vehicle engineering studies. Our aim is to provide the required knowledge to graduates, required to manage development, design, dimensioning, manufacturing and analyzing internal processes of different vehicles. The students will also be prepared to management tasks and to creatively participate in Research & Development related tasks. These studies prepare students for our PhD programmes.

Specializations: Automotive vehicle engineer, aerospace vehicle engineer, naval vehicle engineer, railway vehicle engineer, Mobile machinery and construction equipment engineer, automated material handling system, Vehicle manufacturing and repairing engineer, Vehicle system engineer, Road and traffic safety engineer, Vehicle automation engineer, Vehicle structure engineer.

Competencies and skills: Possessing the MSc degree, vehicle engineers are able:

- to integrate a system oriented and process analysing way of thinking directed on vehicles and mobile-machinery, having a role in transportation processes,
- connected with the specialization selected, to carry out assessments, to develop, design, organise and control complex systems of vehicle technology.

Basic specialization accepted to the input without any conditions:

- basic specialization of transportation engineering

Basic specialization accepted to the input under given conditions:

- mechanical engineering;
- mechatronics engineering;
- military staff, and safety technology engineering;
- agricultural and food industrial engineering;
- engineering informatics.
MSc in Transportation Engineering

Length of study: 4 semesters

Program objectives: The 4 semester long master education programme is a continuation of the bachelor studies. Our aim is to train graduates, who will be able to analyze, plan, organize and control transport related processes in an integrated way considering economic, safety, environmental and human resource aspects. Graduates will be able to deal with tasks of transport administration and transport authorities, choice and operation of vehicles and facilities of passenger and good transportation systems and related infrastructural, control and IT system elements. The students will also be prepared to higher management tasks, to creatively participate in research & development tasks. These studies prepare students for our PhD programme.

Specializations: Transportation systems, Transportation automatization, Transportation engineer manager, Freight forwarding management, Air Traffic Management.

Competencies and skills: Possessing the MSc degree, transportation engineers are able:
- to recognize connections between systems and processes of transportation, to evaluate and to handle them in the framework of system theory, as well as to apply the related principles and methods,
- connected with the specialization selected, to carry out state assessments, to develop, design, organise and control complex transportation systems.

Basic specialization accepted to the input without any conditions:
- basic specialization of transportation engineering

Basic specializations accepted to the input under given conditions:
- mechanical engineering;
- mechatronics engineering;
- military staff and safety technology engineering;
- civil engineering;
- engineering informatics;
- light industry engineering.

MSc in Logistics Engineering

Length of study: 4 semesters

Program objectives: The 4 semester long MSc study is a continuation of the BSc studies. Our aim is to train graduates, who will be able to plan, organize and control corporate logistics systems, good transport systems and supply and distribution networks. Furthermore they will be able to join to developing logistics systems related machines and tools. The students will also be able to deal with complex logistics system modeling and optimization, they understand operation and planning principles of corporate logistics systems, distribution networks and supply chains. The students will also be prepared to manage leading tasks, to creatively participate in R&D related problem, and continue their studies later on our PhD programme.

Specializations: Corporate logistics and operations planning, Technical logistics, Freight forwarding management.

Competencies and skills: Possessing the MSc degree, logistic engineers are able to interconnect the component-processes of logistic systems and the component-units performing the physical realisation of the former relationships.

Basic specialization accepted to the input without any conditions:
- basic specialization of transportation engineering

Basic specialization accepted to the input under given conditions:
- mechanical engineering;
- mechatronics engineering;
- military staff, and safety technology engineering;
- agricultural and food industrial engineering;
- engineering informatics;
- light industry engineering.

Admittance to master courses (MSc) ensured by the announced training, partly in English language, is possible in case of meeting the input conditions, passing entrance examination and in case of at least 5 students’ participation.
**Description of the Doctoral training**

The highest level of the faculty’s education is represented by the Kandó Kálmán Doctoral School, where the PhD students are being prepared for scientific research and a possible career as a professor and researcher. The programme’s tasks deal with transportation, vehicle industry and logistics related questions, which actual topics are frequently updated.

The 4 year program lets the students take part in professional subjects and courses, teaching activities and individual scientific research tasks. The programme will deepen the students’ knowledge in 3 main fields: high level natural science, foundation of profession and specialist subjects in vehicles and mobile machines, transportation and logistics sciences. Furthermore they will gather knowledge through specific optional subjects.

The high quality of the education is guaranteed by the well recognized core members of the programme. Research activity is being lead by a professional supervisor, and the PhD students will show their results through their publications and later in their dissertation.

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### Curriculum of MSc in Vehicle Engineering

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## Curriculum of MSc in Vehicle Engineering (Contd.)

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## Curriculum of MSc in Transportation Engineering

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## Curriculum of MSc in Logistics Engineering

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<tr>
<th>Subject</th>
<th>Code</th>
<th>Lecture / Practice / Laboratory / Exam type / Credit</th>
<th>Prerequisites</th>
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Description of M.Sc. Subjects
Master Section in Vehicle Engineering

Advanced Driver Assistance Systems
BMEKOGGM657
Dr. Zsolt Szalay
(4 credits)

Advanced Flight Theory
BMEKORHM620
Dr. József Rohács

Advanced materials and technologies
BMEKOGGM601
Dr. Krisztián Bán
(5 credits)

Aircraft design and production I.
BMEKOVRM629
Dr. Dániel Rohács
Aircraft development philosophies.: the role of aviation in economy, major problems of aviation and aeronautical industry, goodness factors and their changes during development processes, general development process, technology transfer, development and design methods, control of the development processes.
Computer aided design processes. Specific aspects of using the CATIA. Surface modeling.
Development and design of the aircraft gas turbines. and their parts. (4 credits)

Computer aided design
BMEKOJSM605
Dr. László Lovas
Control theory
BMEKOJSM142
Dr. József Bokor
The course provides deepening of knowledge in control theory. Provides theoretical knowledge, and discusses modern tools, which are necessary in later eengineering practice. This is introduced through different examples, taken from vehicle and transportation systems. (3 credits)

Environment Sensing in the Vehicle Industry
BMEKOKAM656
Dr. Tamás Bécsi
The course aims the introduction of the main sensor technologies of the vehicle industry. Among these, Ultrasonic, radar, Lidar, and camera based methods are discussed. (4 credits)

Instrumental tests for motor vehicles, measurement technology
BMEKOGGM668
Dr. Bálint Szabó
Based on the requirements of the current vehicle engineer education this subject gives a deep knowledge on methods of vehicle tests and measurement systems. Methods and tools of vehicle dynamical tests are introduced. It focuses on the dynamical measurements of the vehicle subsystems like brake system, steering system and the suspension. According to the present requirements of vehicle developments the demonstration of the test bench based HIL tests are part of the education. Besides the vehicle dynamical measurements, it is essential to get familiar with the fuel consumption measurements and with the emission tests performed on roller test bench. To introduce the modern engine testing methods, engine test bench mearements will be carried out during the course. Alongside the development related test, the latest diagnostic measurement methods will be introduced as well. (4 credits)

Machine Intelligence
BMEKOALM644
Dr. Tamás Szirányi
This subject teaches the students basics of machine intelligence in order to understand and be capable to apply them. (4 credits)

Measurement techniques and signal processing in vehicles
BMEKOKAM635
Dr. Alexandros Soumelidis
Provides knowledge about the instrumental measurment and evaluation of the vehicle paramaters. Furthermore introducing sensing and measurement principles, signal processing, traffic measurement. Theory of sensorfusion, sensor networks of the vehicle dynamics measurement. State estimation, parameter estimation, Kalman-filter. Applications in vehicle control systems. (8 credits)

Mechanics of superstructure materials
BMEKOJSM663
Dr. Péter Béda
Modeling of materials. Role of the constitutive equation, principles of its building. Types of material laws, typical behavior issue from experiments. Presentation and study of elastic and plastic bodies. Rheological models. Application examples. (4 credits)

Numerical methods
BMEKOVRM121
Dr. Rohács József
Operation of railway vehicles

BMEKOVM409
Dr. József Csiba

Service processes for railway vehicles. Vehicle input, the actual service timing and vehicle output as components of a random service process. Inventory problems in the operation of railway vehicles, the theory of minimum cost-storing and purchase. Statistical theory of the operating system of railway vehicles based on the technical state. Analysis of the operation reliability of railway vehicles, reliability-based operation/maintenance (RCM system). Railway vehicle diagnostics, vehicle diagnostics and stationary equipments, stations. Systems for identifying of vehicles and their operational modes. Operational properties of braked trains, braking-difficulties, dynamical- and thermal processes. (3 credits)

Practice in technology of manufacturing and materials in vehicle industry

BMEKOGGM648
Dr. Krisztián Bán

(4 credits)

Programming in C and Matlab

BMEKOKAM603
Dr. Tamás Bécsi

The course aims the introduction to programming in C and Matlab languages. (4 credits)

Railway vehicle system dynamics

BMEKOVRM608
Dr. Zoltán Zábori


Requirements for superstructure designers

BMEKOJSM662
Dr. Péter Béda

Manufacturer’s requests for vehicle superstructure designers. Manufacturer’s rules for superstructures and assembling. National and international laws. Preparation for manufacturing. (4 credits)

Road safety, legislative environment, human factors

BMEKOGGM653
Dr. Gábor Melegh

Legal studies: an extract from the constitutional law, substantive and procedural civil law, criminal law, criminal procedural law, driving offences, issues of damages claims. Human factors in road traffic: personality characteristics, behaviours, human health protection, generational problems, effects of weather and seasons, special related questions of vegetation and fauna, damages caused by wild animals. Personal injuries: the human body, physiological particularities, classification of injuries, examination of accidents in the light of injuries, examination of blood alcohol concentration, examples of medical investigation of accidents. (4 credits)

Ship design

BMEKOVRM615
Dr. Győző Simongáti

The course aims at introduction of the process of ship design, the design spiral, determination of main particulars, lines planning, optimisation techniques, conceptual design, preliminary design methods, tonnage calculation, etc. (5 credits)

Simulation of technical systems

BMEKOALM645
Dr. Gábor Bohács

The subject introduces to the students software background which can be used as a virtual reality to support engineering decisions. (4 credits)

Surface Engineering

BMEKOGGM647
Dr. Tamás Markovits


Suspension design

BMEKOGJM613
Dr. Bálint Szabó

Analysis of forces acting on wheel using modern tyre-models, knowing objective functions of static and dynamic geometrical parameters of tyres, necessary for design. Geometrical design of tyre suspension, structural design of each part of suspension (rods, arms, ball joints, rubber mountings). Vibration analysis of vehicle, geometrical and structural design of elements of suspension (coils, springs, shock absorbers, stabilizers, motion boundary elements) in regard to requirement systems of suspensions. Dynamical analysis of braking vehicle in order to determine design requirements; methods for proportioning brake force between axles; design of conceptual schema of brake system; geometrical, structural, thermo- and fluid dynamical design of each parts. Determination of initial data needed to design the steering system using dynamical analysis of steering; design of steering mechanism; geometrical and structural design of elements of steering systems (tie rod, track rod, steering-gear, steering wheel and axle, ball joints). (4 credits)

Theory of Ships III.

BMEKOVRM616
Dr. Győző Simongáti

The aim of the course is to introduce the special cases of stability to the students. Topics are: deterministic and probabilistic damaged stability methods, grounding, docking, stability of floating cranes, split barges. (3 credits)
Vehicle operation, reliability and diagnostics

**BMEKOVRM602**

Dr. József Csiba


**Accident analysis I., forensic processes**

**BMEKOGGM654**

Dr. Gábor Melegh

Technical causes of road traffic accidents, malfunctions of vehicles and engines; the most occurring malfunctions of vehicles and its engines, causing great damages. Identifying the root causes of accident from incurred damages, ascertainment of the technical responsibility, conclusions, options of accident avoidances. Role of vehicles, explanation of technical malfunctions, analysis of road traffic accidents occurred for technical reasons, contribution of subjective causes. Evaluation of accident forms: Main forms of accident and conclusions deductible from conditions after accident. Accidents attendant on hitting pedestrians, fundamental calculation methods, evaluation of hitting pedestrian overstepping form covering, accidents occurred in reduced visibility, experimental reconstruction of traffic accidents. Vehicle collision: substantial formulas of crashes, crash-calculation by analytical and graphical methods; deformations of vehicles and pictures of damages, energy grid. (4 credits)

**Aircraft analysis I.**

**BMEKOVRM631**

Dr. Károly Beneda

The aim of the course is to introduce the analysis techniques of aircraft and powerplants. (4 credits)

**Aircraft design and production II.**

**BMEKOVRM630**

Dr. Balázs Gáti

Aircraft Design II. (4 credits)

**Computational fluid- and thermodynamics**

**BMEKOVRM606**

Dr. Árpád Veress

The goal of the present subject is to prepare students for the state of the art application of CFD calculation methods in the vehicle engineering with including thermodynamics and heat transfer. (4 credits)

**Construction of vehicle manufacturing systems I.**

**BMEKOGGM649**

Dr. Tamás Markovits

(4 credits)

**Design methods of drive systems**

**BMEKOALM646**

Dr. Gábor Bohács

This subject aims to introduce the construction and materials handling machines’ specific drive systems, construction and examination methodology. (3 credits)

**Design of material handling machine design**

**BMEKOKAM627**

Dr. Gábor Bohács

Design and norming of material handling machines. Capacity and power requirement calculation for machines of bulk materials. Design of material handling machines for unit loads, especially forklifts and cranes. (5 credits)

**Design of pleasure craft**

**BMEKOVRM625**

Dr. Győző Simongáti

The course aims at introduction of the specialities pleasure craft design. (4 credits)

**Diesel and electric traction**

**BMEKOVRM610**

Dr. András Szabó

Design properties of railway Diesel engines, dynamical processes of injection and control systems. Turbocharging systems of railway diesel engines. Design properties of Diesel-hydraulic and Diesel-electric powertrain system design, machine-group optimization, transient operation processes. Drive dynamics of electric traction units, electromagnetic, controlled systems. Analysis of the work done and energy-consumption, hydraulic/electro-dynamic braking of trains of Diesel and electric traction units, and their optimization. (5 credits)

**Discrete Control Design**

**BMEKOKAM658**

Dr. Péter Gáspár

The course aims the presentation of discrete control theory. Besides the theoretical and mathematical design aspects, implementation issues are also discussed. (4 credits)

**Dynamics of vehicle, active- and passive safety**

**BMEKOGJM641**

Dr. Gábor Melegh

Analysis of the forces acting on the wheels, state of the art tyre-models, static and dynamic geometric characteristics of tyre from the point of view of traffic safety. Analysis of force and moment conditions of transmission systems, examination of dynamic parameters of mechanical and hydrodynamical torque converter. Geometry of tyre suspension, load of each elements of suspension. Vibrational theory of vehicle, parts of suspension. Dynamic analysis of vehicle braking; methods for proportioning brake force between axles of vehicle; conceptual schema of different types of brake systems; geometrical-, mechanical-, heat-
and hydrodynamics loads of single part.
Dynamical analysis of steering, geometrical and mechanical design of parts of steering systems (tie rod, track rod, steering gear, steering wheel and axle, ball joints).
Review of software solutions applicable for making vehicle dynamic models; examination of longitudinal and transverse vehicle dynamics, methods for controlling vehicle dynamics. Dynamical examination and modelling of vehicle's roll over process.
Active and passive components of vehicle safety: control systems of vehicle dynamics, introducing systems which are suitable to mitigating consequences of accidents. Detailed review of sensors and actuators which are parts of these systems. Uses of data stored in these systems' ECU's for reconstruction of an accident. (4 credits)

Electronics – electronic measurement systems
BMEKOKAM103
Dr. Géza Szabó
The subject gives basic knowledge of electronics and electronic measurements and their application in different areas of transportation. It summarizes the operational modes of basic components and basic circuits and describe how one can design and apply them. It gives an overview of electric and mechanical measurements and how the results of measurements can be processed (4 credits)

Engine design I.
BMEKOOGGM670
Dr. Huba Németh

Fixing and sealing
BMEKOOGGM650
Dr. Krisztián Bán
(4 credits)

Machines of construction material production
BMEKOALM672
Dr. Gábor Bohács
Computer aided construction of crushing machines. Motion equations of vibrating sieves. Construction of concrete mixers. Reinforcing steel processing equipment sizing and system control features. (5 credits)
### Traction mechanics

<table>
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<tr>
<th>Code</th>
<th>Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BMEKOVRM619</td>
<td>Dr. István Zobory</td>
<td>4</td>
<td>Factors of train motion. Tactive effort, braking force, track force. The tactive and braking forces applied in the control system influencing the torque conditions of the rotating components. Determining the train-weight that can be started, the construction Koreff-figure. Detreming the speed-timning diagrams by means of simulation using dynamical models. Taking into account the limit force that can be transferred through the rolling contact, without macroscopic sliding. The longitudinal dynamics of trains. Dynamics of train-tearing. Dynamics of special train motions: shunting, marshalling, hump. Energy demand of train motion, simulation of energy consumption with Diesel- and electric traction. Outlook to the sphere of problems of energy optimum train control, basic principle for the application of traction and braking forces, the numerical layout of the optimum train control. (3 credits)</td>
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### Transmission system design

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<tbody>
<tr>
<td>BMEKOGJM612</td>
<td>Dr. Huba Németh</td>
<td>4</td>
<td>Main parameters of vehicle mechanics. Construction of an arbitrary selected transmission component (clutch, gearbox or final drive), set-up of functional dimension based on vehicle dynamic calculations, geometrical construction of all components, structural dimensioning of gears, shafts and bearings for load and lifetime, construction and dimensioning of actuation mechanisms, design of housings and fixation points. (4 credits)</td>
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### Vehicle automation systems

<table>
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<tr>
<th>Code</th>
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<tbody>
<tr>
<td>BMEKOGGM659</td>
<td>Dr. Zsolt Szalay</td>
<td>4</td>
<td>Analysis of dynamical models apt for examining the main motion of vehicles and vehicle-strings, as well as traffic flows. The non-linear dynamic model of the force transfer in rolling contact with regard to stochasticity coming from tribological properties. Motion equations of lumped parameter models capable for vibrations describing vehicle system. The forces and motion excitation, as well as parametric excitations. The stochastic ordinary differential equation system of the discrete dynamical system. Construction of motion equation systems of distributed parameter vehicle systems. The stochastic partial differential equation system of the distributed parameter dynamical system. The vehicle dynamical systems as a controlled or regulated section. Formulation of some typical vehicle dynamical task for control, with operation-technical explanation of the control signals. The vehicle control problem formulated by model based methods. Methods apt for designing vehicle control. Failure detecting in the vehicle control system. Design of vehicle control of reconfiguring and fault-tolerant character. Design of integrated control and inspection control. Case studies concerning controlled vehicle dynamical systems. (8 credits)</td>
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### Accident analysis II., simulation methods

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<tbody>
<tr>
<td>BMEKOGGM655</td>
<td>Dr. Gábor Melegh</td>
<td>5</td>
<td>Description of crash-models used in software solutions for accident reconstruction. Examination and analysis of complete regular and irregular vehicle motion process with simulation methods. Specifying the parameters which are necessary for simulation; confinement the circle of questions answerable by available parameters and data in a concrete case. Interpretation of probabilistic ascertainments. Parameter sensitivity analysis of simulation results. Evaluation, analysis and explanation of results provided by simulation software; plausibility of results. (5 credits)</td>
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### Analysis of Aircraft II.

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<tbody>
<tr>
<td>BMEKOVRM632</td>
<td>Dr. Balázs Gáti</td>
<td>7</td>
<td>Theory of mechanical construction of the building machines. Handling special load cases of the building industry’s tasks. Preparation of a complex task relating construction machines. (5 credits)</td>
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### Computer aided manufacturing

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<tbody>
<tr>
<td>BMEKOGGM618</td>
<td>Dr. Zoltán Pál</td>
<td>4</td>
<td>(4 credits)</td>
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### Construction machinery design - project

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<tbody>
<tr>
<td>BMEKOALM674</td>
<td>Dr. Gábor Bohács</td>
<td>5</td>
<td>Theory of mechanical construction of the building machines. Handling special load cases of the building industry’s tasks. Preparation of a complex task relating construction machines. (5 credits)</td>
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### Construction mechanization project planning methods

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<tbody>
<tr>
<td>BMEKOALM673</td>
<td>Dr. Gábor Bohács</td>
<td>5</td>
<td>Management of construction projects from mechanization aspects. Compilation of machine chains and systems. Capacity planning and scheduling. Determining operational parameters of earthwork machines and other construction machinery. (5 credits)</td>
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### Construction of vehicle manufacturing systems II.

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<tbody>
<tr>
<td>BMEKOGGM651</td>
<td>Dr. János Takács</td>
<td>5</td>
<td>(5 credits)</td>
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### Design and testing of railway vehicle systems

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### Design methods of material handling systems

**BMEKOALM642**  
Dr. Gábor Bohács  
Characteristics of structure and operation of material handling systems. Mechanical connections and communication issues among the systems' components. Identification methods for bottlenecks. Planning operational strategy of material handling systems. Safety in material handling systems. (5 credits)

### Design of material handling machines - project

**BMEKOALM643**  
Dr. Gábor Bohács  
During the classes students learn most relevant issues of materials handling equipments' mechanical construction. Construction of a selected materials handling machine is also carried out by students. (5 credits)

### Design of Vehicle Automation Systems

**BMEKOKAM661**  
Dr. Tamás Bécső  
The course aims the strengthening of project design skills through a large individual student project. (7 credits)

### Engine design II.

**BMEKOGGM671**  
Dr. Huba Németh  

### Measurement systems in vehicle manufacturing

**BMEKOGGM652**  
Dr. Pál Bánlaki  

### Mechatronic design of vehicle systems

**BMEKOGGM622**  
Dr. Zsolt Szalay  

### Production process quality assurance in the vehicle industry

**BMEKOGGM611**  
Dr. Zsolt Stukovszky  
(2 credits)

### Project

**BMEKOVRM633**  
Dr. Árpád Veress  
In this subject the students have the possibility either to work as a trainee at an aircraft design office or get involved in a project running at our department. (3 credits)

### Project work

**BMEKOVRM628**  
Dr. Győző Simongáti  
In this subject the students have the possibility either to work as a trainee at a ship design office or get involved in a project running at our department. (2 credits)

### Projectmanagement in automotive industry

**BMEKOKKM617**  
Zoltán Nagy  
Project management can play an important role in the current wave of product development reengineering taking place in the automotive industry. In this course those special project management processes and tools can be studied which are necessary during automotive product development. (2 credits)

### Reliability, Safety and Security in the Vehicle Industry

**BMEKOKAM660**  
Dr. Balázs Sághi  
The aim of the course is to provide the students with theoretical and practical knowledge about the approach and methods for designing reliable, safe and secure vehicle systems. (3 credits)

### Research and development process in the vehicle industry

**BMEKOGGM614**  
Dr. Zsolt Stukovszky  
(2 credits)

### Ship hydrodynamics

**BMEKOVRM626**  
Dr. Győző Simongáti  
The subject aims to introduce the basic analytical and numerical methods for calculation of ship resistance, water velocity and pressure distribution around hull. International and practical recommendations for numerical calculations of ship hydrodynamics. (4 credits)

### Ship strength

**BMEKOVRM621**  
Dr. Győző Simongáti  
The course aims to explain numerical methods for calculating ship strength, and to introduce the verification calcula-
tion methods of ship strength according to the legal regulations, international standards and classification societies. (4 credits)

**Superstructure control technics**

**BMEKOJSM666**

*Dr. Ferenc Pápai*

Traditional hydraulic drives. Electrohydraulic drives, sensors, actuators. Presentation of the onboard electronic devices. Definition of stability and overload criteria. Accident prevention. (5 credits)

**Vehicle evaluation, traffic environment**

**BMEKOGJM640**

*Dr. Gábor Melegh*

Students know the basics tasks and expectations connected to making damage survey, determination of the repair costs and depreciation after repairs (or betterment). They are informed of the related disciplines, which directly or indirectly connected to these questions. Knowledge about different types of vehicle insurances. Detailed review of catalogue systems used for vehicle evaluation and calculating repair coast. Examination of special questions of maintainability and deterioration of vehicles. Solving specific vehicle evaluation problems with statistical methods. Human factors of driving road vehicles, reaction time, perception and perceivability. (5 credits)

**Vehicle simulation and optimisation**

**BMEKOVJM638**

*Dr. Vilmos Zoller*


**Vehicle superstructure design**

**BMEKOJSM667**

*Dr. László Lovas*

Superstructure construction regarding the needs of manufacturable design and tooling. Optimization of superstructures (weight, rigidity, manufacturing). (5 credits)

**Vehicle system informatics**

**BMEKOVJM437**

*Dr. Ferenc Kolonits*

Description of M.Sc. Subjects
Master Section in Transportation Engineering

Control theory
BMEKOKAM142
Dr. József Bokor
The course provides deepening of knowledge in control theory. Provides theoretical knowledge, and discusses modern tools, which are necessary in later engineering practice. This is introduced through different examples, taken from vehicle and transportation systems. (3 credits)

Decision making methods
BMEKOKKM221
Dr. Zoltán Békefi
Introduction of the most important methods of operations research and their applications in the transport sector. (5 credits)

Intelligent transport systems
BMEKOKUM205
Dr. János Tóth
The components of intelligent transport systems. The application of ITS on highways and in urban transport. Supporting private and public transport by road and passenger information systems. Traffic management systems. Geographical Information Systems (GIS) in transport. The features and planning principles of GIS databases in transport. The methods of positioning, tracking systems. The vehicle detection and identification systems. Route planning methods. Fleet management. (5 credits)

Mathematics MK
BMETE90MX59
Dr. Sági Gábor
(4 credits)

Road Safety
BMEKOKKM222
Dr. János Juhász

Transport automation
BMEKOKAM202
Dr. Balázs Sághi
Main topics of the subject include: Basic principles of safety.
- Development of safety-critical systems
- System life cycle models
- Safety requirement specification, safety criterion
- Hazard and risk analysis techniques
- Safety integrity of systems
- Safety analysis
- Failure management of safety critical systems
- Introduction to formal techniques, Petri nets
(4 credits)

Transport Economics
BMEKOKGM201
Dr. Ferenc Mészáros
Analysis of EU transport strategies in different modes. Monetarising and internalising of transport externalities. (4 credits)

Air Traffic Management (ATM)
BMEKOVRM224
Dr. Dániel Rohács
The course aims at introduction to the basic principles of air traffic control, the categories of airspaces and the main methods and support systems of ATC. The course examine the most important human factors and the main researches. (3 credits)

Communications, Navigation and Surveillance (CNS) I.
BMEKOKAM226
Dr. Dóra Meyer
The aim of the subject is to provide deeper knowledge on planning and operating of air transportation related navigation systems, facilities or devices that have been operationally released to be used either by airspace users (e.g. ground navigation facilities) directly, or are used in the provision of operational air traffic management services. (3 credits)

Controlling systems in transportation
BMEKOKGM215
Dr. Ferenc Mészáros
Introduce the technical, legal, economic, financial, social and institutional frameworks and directives that control operation and improve integration, development of transportation system in European Union. Promoting their domestic adaptation and application. (6 credits)

Electronics – electronic measurement systems
BMEKOKAM103
Dr. Géza Szabó
The subject gives basic knowledge of electronics and electronic measurements and their application in different areas of transportation. It summarizes the operational modes of basic components and basic circuits and describe how one can design and apply them. It gives an overview of electric and mechanical measurements and how the results of measurements can be processed (4 credits)

Forwarding Management 1
BMEKOKKM132
Dr. Ferenc Mészáros
History and attributes of freight forwarding, international agreements, different contract types, rules of extra ordinary freight forwarding, legal framework of customs, tasks of national and international forwarding services. (5 credits)
I+C technologies

**BMEKOKAM104**
Dr. Tamás Bécsi
The course aims at introduction to the basic principles of modern computer architectures, and especially computer systems and communication techniques which are of high importance in transportation. (3 credits)

Information connection of the vehicle and the track

**BMEKOKAM232**
Dr. Géza Szabó
The subject gives an overview of information transmission between infrastructure and vehicles, both logically and physically. Examples are given for railway, road and air transportation sectors. (3 credits)

Material handling and warehousing processes

**BMEKOALM225**
Dr. Gábor Bohács
The specific properties and main groups of the materials in the logistics systems. The functions of the packaging, packaging nation’s economic role. The classification of packaging, packaging materials - different materials, packaging materials, packaging accessories. Cargo unit creation. Characteristics of the material handling systems, the main groups, material handling tasks, material flow characteristics. The main groups of material handling machines and techniques. Performance and reliability of the material handling systems. Calculation of the material handling time. Material handling process examination. Secondary analysis, layout planning. Conventional storage systems, high bay warehouse systems. Order picking. Statistical sampling procedures. Tenders. (4 credits)

Meteorology

**BMEKOVRM231**
Dr. Rohács Dániel
The course aims at introduction to meteorological phenomena and conditions, the structure of the atmosphere and other important aviation weather informations. (3 credits)

Modelling and control of vehicles and traffic systems

**BMEKOKAM233**
Dr. István Varga
Design of road traffic systems and traffic modeling practice with state-of-the-art design software:
- microscopic modeling with VISSIM,
- advanced use of VISSIM via COM programming with MATLAB,
- macroscopic traffic planning (classical four-step approach) with VISUM
- application of MATLAB for freeway traffic modeling and control,
- introduction to the application of QGIS. (6 credits)

Numerical methods

**BMEKOVRM121**
Dr. Rohács József


Smart City

**BMEOKKM227**
Dr. János Tóth
Smart city introduction, land use functions and models, city planning, utilization of social media, Internet of Things, wireless sensor networks, Smart Grids, lighting, best practices. (3 credits)

Transport informatics

**BMEOKKM223**
Dr. Csaba Csiszár
The subject is based on Transport information systems I. and II. Main topics: modelling of con-cepts, relations and regularities in information systems and applying of these models in trans-portion. The structure and operation of the transportation organizations and operational con-trol processes (preparation, execution and accounting) are also lectured. (5 credits)

Transport Infrastructure Management

**BMEOKKM228**
Dr. Ferenc Mészáros
Role of transportation networks and regulatory policies. Asset valuation, asset management techniques and systems. Operation contracts, risk sharing and management. Tasks in adaption to climate change and sustainability principles. (3 credits)

Transport modelling

**BMEOKKM229**
Dr. János Tóth

Transport operation

**BMEOKUM206**
Dr. Péter Mándoki
Planning of intermodal node. Infrastructure and vehicles of different transport modes. (5 credits)

Air Traffic Control

**BMEKOVRM235**
Dr. Dániel Rohács
The course aims at introduction to the basic principles of air traffic management, the history and the main methods of ATM. The course examine the most important elements of the management system, the advantages and disadvantages and the researching of ATM. (4 credits)
Case study

BMEKOVRM237
Dr. Dániel Rohács
The students have to participate in one of the R+D projects of the faculty. (3 credits)

City logistics

BMEKOALM244
Dr. Bóna Krisztián
The main types of transport goods in the city supply networks. The rule of city logistics in the global logistics networks, the definition of last mile problem. The application of transporting systems in the city logistics. Loading technology in the city logistics. The rule of logistics providers in the city supply, the integration of city logistics in the gateway conception. The urban consolidation centres ans x-docks. The control and organisation of city logistics in big cities. Best practises in worldwide. Application of modelling techniques is the organisation and operation of city logistics systems. Informatics in city logistics. (5 credits)

Communications, Navigation and Surveillance (CNS) II.

BMEKOKKM239
Dr. Rita Markovits-Somogyi
The course aims at introduction to the systems of navigation, surveillance and data process. The course examine the basic principles of voice communication, the data technologies of air traffic control and complement of the knowledge of course CNS I. (4 credits)

Engineering of transport automation systems

BMEKOKAM234
Dr. Balázs Sághi
The aim of the subject is to provide deeper knowledge on planning of transportation systems. Rules, legislation basics, guidelines for different domains are introduced, planning phases are touched and project work is expected from students. (6 credits)

Environmental effects of transport

BMEKOKKM230
Dr. János Tóth
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. 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. Demand management, parking and road charges. Requirements of fuel efficiency, alternative fuels, energy efficient and environmentally enhanced vehicles. (4 credits)

Financing techniques in transportation

BMEKOKKM236
Dr. Zoltán Békéfi
Concepts of financing: financing goals (development, operation); financing options: budget, private or public-private partnerships (PPP); loan, bond, lease and their characteristics. Project analysis and evaluation methods. Project identification, technical preparation, traffic forecast and modeling. Risk assessment needs. Feasibility studies, cost-benefit analysis, financial, social, legal, regulatory and technical compliance criteria. The identification of project risks. Definition of government, regional and local priorities. The role of the partners in the project financing. Communication tasks. The media’s role for accepting the project financing methods by the society. Optimizing fees and tariffs. Financial structures and models. Contracts. (5 credits)

Forwarding Management 2

BMEKOKKM133
Dr. Ferenc Mézsáros
Mode specific knowledge of freight forwarding management (road, rail, aviation, inland waterway and maritime, combined and LTL transport). (5 credits)

Forwarding marketing

BMEKOKKM135
Dr. Botond Kővári
Marketing concepts, overview of resources. Market analysis methods. Product mix reviews. Advertising strategies. (4 credits)

Human resource management in transportation

BMEKOKKM238
Dr. Botond Kővári
Applied human resource challenges, especially in transportation. Motivation, team working, carrier planning. (3 credits)

Management of transport and logistic services

BMEKOKGM217
Dr. Botond Kővári
The main aim of this course is to develop and implement performance measurement in a transport or logistic organization with the help of a balanced KPI (key performance indicator) system. (6 credits)

Passenger transportation

BMEKOKUM208
Dr. Csaba Csizsár
Characterization of passenger transportation systems, properties, planning process. Evaluation of system. Modelling of motion process in regional area. Qualitative system of passenger transport, service levels. Planning of system elements of passengers transport (local and inter-town), in individual and public transport. Overview and summary of properties of the advanced, so called “transitional” passenger transportation modes (e.g. car-sharing, bike-sharing, car-pooling, chauffeur service, demand responsive transport) in system and process-oriented approach. (5 credits)

Project

BMEKOKAM242
Dr. Balázs Sághi
Project work (3 credits)
Project management in transportation

**BMEKOKKM241**

Zoltán Nagy

This course is an introduction to project management in the transportation sector and basic concepts and tools for developing the student’s skills. During this course are presented the most relevant concepts on the formulation and preparation of different transport developing projects and their scheduling and control techniques. Students work with different models and tools for setting professional goals, time management, teamwork and communication techniques. (2 credits)

Safety in air traffic control

**BMEKOKAM243**

Dr. Dóra Meyer

The aim of the subject is to provide deeper knowledge on planning of safety certification in air traffic control. Rules, legislation basics, guidelines for different domains are introduced, planning phases are touched. (3 credits)

Signal processing in transport

**BMEKOKAM211**

Dr. József Bokor

Introducing the microcontroller architectures used extensively in transportation systems. Embedded system design, and software development. Digital signal processing: A/D and D/A conversion, filtering and DSPs. Safety critical hardware and software design and implementation. (5 credits)

Supply and distribution processes

**BMEKOALM240**

Dr. Gábor Kovács

The basics of organizing supply chains (SCM), enterprise logistics system. The organization of the material supplies, material analysis methods (ABC, XYZ), supply strategies (synchronized, by stocking, on request), material planning methods (Gozinto graph, BOM). The inventory systems and processes (rotation indicators), inventory valuation (FIFO), inventory model (EOQ). Distribution systems, demand forecasts (simple methods). Production logistics (MRP, APS, Kanban, Lean). The definition and main tasks of the reverse logistics. (2 credits)

Trade, Financial, Accounting Techniques

**BMEKOKKM138**

Dr. Ferenc Mészáros

General principles of international trade, stakeholders and their relationships, trade transactions. Set and elements of the banking system, frequent financial transactions of freight forwarders. Accounting obligations and techniques of freight forwarding companies, balance sheet and profit and loss statement. (3 credits)

Traffic flow

**BMEKOKUM204**

Miklós Közel

Analysing, modelling and planning of traffic flow on road transportation network, in consideration of passenger and goods transport. Probability distributions, vehicle in winding way, phasing of traffic lights, road markings, traffic signs, pedestrian flow, traffic calming zones (4 credits)
Description of M.Sc. Subjects
Master Section in Logistic Engineering

Control theory
BMEKOKAM122
Dr. Péter Gáspár
The course provides deepening of knowledge in control theory. Provides theoretical knowledge, and discusses modern tools, which are necessary in later engineering practice. This is introduced through different examples, taken from vehicle, transportation and logistics systems. (5 credits)

Lean management
BMEKOALM322
János Kosztolányi
Methods of continuous improvement. The teamwork, establishment of suggestion systems, the role of motivation. Main brainstorming methods, the advantages and disadvantages of each method. Introduction and application of problem finding tools, methods for failure analysis, applicability of the main methods. Data request for failure analysis methods. The basics of standardization, the steps of making standard processes, the zeri failure concept (jidoka, Poka-Yoke), production equalization in lean mnedzsment: mathematical methods for Heijunka. Process development methods, and techniques. The importance of changeover time, methods for the reduction os changeover time in the companies. The basics of ergonomics, types of workplaces from the aspect of ergonomics, the steps of REBA analysis. Lean office methods and tools. The basics of Six Sigma method, mathematical background, the levels of quality. Description of six sigma analysis, evaluation of the results. The relationship between six sigma and lean. (4 credits)

Logistics controlling
BMEKOKKM330
Dr. Szabolcs Duleba
The primary task of logistics controlling is managing all logistics activities using comprehensive measures on all levels of a company with the provision of information processing systems based on the management’s information needs. After the completion of this module, the graduate will have the knowledge and an understanding of the fundamentals and characteristics of reporting systems for logistics, logistics accounting and cost accounting, activity-based costing, strategic logistics controlling and logistics benchmarking. (3 credits)

Logistics information system planning
BMEKOALM321
Dr. Jenő Tokodi
Logistics information system (LIS) databases. LIS planning. IT representation of system elements, purchase orders, sales, production, quality assurance. System and software planning methods. IT representation of data formats, schemes, process description. Service oriented architecture, webservises, interfaces, Enterprise Service Bus, Orchestrating. ERP webservises, workbench, dictionary, business warehouse, reporting. BI systems. Transactional database. (5 credits)

Mathematics ML
BMETE90MX60
Dr. Gábor Sági
(5 credits)

Planning of extra-logistics networks
BMEKOALM337
Dr. Krisztián Bóna

Algorithm Design
BMEKOKAM326
Dr. Tamás Bécsi
The course aims the introduction of algorithm theory and numerical complexity. (5 credits)

Automation of logistics systems
BMEKOALM325
Dr. Gábor Kovács
This subject introduces integration of logistics automation into the higher levels of corporate governance. Communication possibilities in PLC networks are also addressed. Introduction of industrial communication protocols and interfaces. Effects of humans, identification and quality checking on automation. (5 credits)

Demand planning and inventory management
BMEKOALM328
Dr. Krisztián Bóna
Specific resource planning areas in the enterprise logistics. Mathematical modeling in the demand planning process, model identification and parameter optimisation. Mathematical modeling in the inventory planning process, select inventory models, optimisation of control parameters, inventory control systems. Measurement of demand and inventory planning efficiency. Specific planning tools of ERP systems. The rule of inventory and demand planning in the S&OP process. (5 credits)

Enterprise logistics project 1
BMEKOALM339
Norbert Antal
Within the framework of the course, project groups are formed from the students, which are led by mentors. The project topics may include: operations management, complex project tasks, R&D tasks, based on the interests of student’s. During the contact hours, the students consult with their mentors, moreover, each week brief report is held. The students present the problems and the suggested solutions, they practice the techniques of discussion, argumentation, and persuasion. (4 credits)

Forwarding Management 1
BMEKOKKM132
Dr. Ferenc Mészáros
History and attributes of freight forwarding, international
agreements, different contract types, rules of extra ordinary freight forwarding, legal framework of customs, tasks of national and international forwarding services. (5 credits)

**Forwarding project 1.**

**BMEKOALM333**

**Dr. Ádám Török**

Executive knowledge in managing freight forwarding companies. (4 credits)

**Logistics planning softwares**

**BMEKOALM336**

**Dr. Jenő Tokodi**

Classification of softwares in logistics planning. Introduction of software tools in corporate process planning, including designing flow chart (EPC, BPMN), Gantt chart, Fishbone diagram. The functions of computer aided design softwares, basic components, transformations, dynamic blocks, scaling, managing layers. Standard symbols of logistics components. Basic of spatial designing. Project management softwares. (3 credits)

**Numerical optimization**

**BMEKOVRM334**

**Dr. József Rohács**


**Process planning**

**BMEKOALM331**

**Dr. Gábor Kovács**


**Simulations planning**

**BMEKOALM335**

**Dr. Krisztián Bóna**

The types of models, the basics and mathematical rudiments of modelling, Stochastic and deterministic processes, and the main process properties. The definition of computer based simulation modelling and the application in the logistics system planning. Simulation algorithms and programming. Simulation and optimization, simulation based optimization methods. The simulation softwares and simulators. Application of simulation based optimization methods in logistics. Application of artificial intelligence in specific logistics optimization problems. Development of simulation systems and models in intra- and extra logistics systems. (3 credits)

**Technical logistics project 1.**

**BMEKOALM333**

**Dr. Gábor Bohács**

During the classes students of the technical logistics specialization learn advanced engineering planning systems, and their relation to the expert field of logisticians. (4 credits)

**Construction of logistics machinery**

**BMEKOALM324**

**Dr. Gábor Bohács**

Introduction of main constructional issues of continuous and discontinuous operating materials handling machines. (3 credits)

**Control of transport logistics**

**BMEKOALM341**

**Dr. Gábor Bohács**

The components of the transport logistics control systems. Summary of GIS funds. Operational control problems and tasks of the transport logistics systems. Mathematical modelling techniques, decision supporting of transport logistics control systems. The mathematical model of transportation network. The shortest path search methods. The exact and the provisional planning. Modelling of routes: direct routes, collecting and distributing routes. The traveling salesman problem (TSP) and the vehicle routing problem (VRP). Soft computing methods. The IT architecture of the freight control systems. The mobile devices. The connection between the freight exchanges and the transport logistics control systems. (3 credits)

**Enterprise logistics project 2.**

**BMEKOALM343**

**Norbert Antal**

As the continuation of the Enterprise logistics project 1., the project groups get operations management tasks, complex project tasks or R&D tasks, based on the interests of student’s. The task can be the continuation of what are launched in Enterprise logistics project 1., however, a new task also can be started. During the contact hours, the students consult with their mentors, moreover, each week brief report is held. The students present the problems and the suggested solutions, they practice the techniques of discussion, argumentation, and persuasion. (7 credits)

**Forwarding Management 2**

**BMEKOKKM133**

**Dr. Ferenc Mészáros**

Mode specific knowledge of freight forwarding management (road, rail, aviaton, inland waterway and maritime, combined and LTL transport). (5 credits)

**Forwarding marketing**

**BMEKOKKM135**

**Dr. Botond Kővári**

Marketing concepts, overview of resources. Market analysis methods. Product mix reviews. Advertising strategies. (4 credits)
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Code</th>
<th>Instructor</th>
<th>Description</th>
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<tbody>
<tr>
<td>Forwarding project 2.</td>
<td>BMEKOKKM342</td>
<td>Dr. Ferenc Mészáros</td>
<td>Executive knowledge in managing freight forwarding companies. (2 credits)</td>
</tr>
<tr>
<td>Integrated material flow systems</td>
<td>BMEKOALM332</td>
<td>Dr. Gábor Bohács</td>
<td>Traditionally materials handling systems are separated from technology. There are however special applications, such as assembly lines in the electronic industry where the material handling systems are in strong integration with the technological equipment. During the classes these special machines are addressed. (4 credits)</td>
</tr>
<tr>
<td>Planning of plant logistics systems</td>
<td>BMEKOALM327</td>
<td>Dr. Krisztián Bóna</td>
<td>The specific properties and planning process of plant logistics systems. The main steps and tasks of logistics planning, The plant layout planning techniques and methods. The specific plant layout topologies. Optimization and heuristic methods in plant layout design. How to create a logistics system plan in case of a plant logistics system? The material flow system architecture in a plant. The planning steps of the material flow systems in a plant. The methodology of material flow system planning, the main heuristic an optimization models. Analytical queueing theory and simulations methods in the planning of plant logistics systems. Integration of the basic arguments of lean in the planning process. (5 credits)</td>
</tr>
<tr>
<td>Planning of warehousing systems</td>
<td>BMEKOALM323</td>
<td>Dr. Krisztián Bóna</td>
<td>The main material flows and processes in a warehouse. Specific logistics system planning methodology of warehousing systems. The typical logistics technology variations of storing. Planning of transporting connections and loading technology. Planning the dimensions of loading bays, and preparation areas of warehouses. Order picking methods and systems. The technology of order picking. Planning of order picking process. Planning the topology and layout of storage systems. How to create a logistics system plan of a warehousing technology? (5 credits)</td>
</tr>
<tr>
<td>Production planning &amp; scheduling</td>
<td>BMEKOALM329</td>
<td>Dr. Krisztián Bóna</td>
<td>Theory of production planning and scheduling. Main topics, goals and constraints in the production systems, the system architecture of production control. Modelling of products and production technology. Connection points to the customer orders and forecasts. Then main production strategies. Production and capacity planning. The time view of production scheduling, the long, middle and short term planning. The informatics of the production planning and scheduling. Production planning and scheduling algorithms. The rule of production planning in the S&amp;OP process. (4 credits)</td>
</tr>
<tr>
<td>Technical logistics project 2.</td>
<td>BMEKOALM340</td>
<td>Dr. Gábor Bohács</td>
<td>During this subject students perform and complete a technical logistics project in groups. These can originate from either the industry or from defined research and innovation tasks. (7 credits)</td>
</tr>
<tr>
<td>Trade, Financial, Accounting Techniques</td>
<td>BMEKOKKM138</td>
<td>Dr. Ferenc Mészáros</td>
<td>General principles of international trade, stakeholders and their relationships, trade transactions. Set and elements of the banking system, frequent financial transactions of freight forwarders. Accounting obligations and techniques of freight forwarding companies, balance sheet and profit and loss statement. (3 credits)</td>
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</tbody>
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