Study plan

Name of study plan: Logistics and Management of Transport Processes

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Logistics and Transport Processes Control
Type of study: Doctoral
Required credits: 0
Elective courses credits: 0
Sum of credits in the plan: 0
Note on the plan:

Name of the block: Compulsory courses in the program
Minimal number of credits of the block: 0
The role of the block: P

Code of the group: D-P-L-25
Name of the group: Compulsory courses Ph.D. L from 25/26
Requirement credits in the group:
Requirement courses in the group: In this group you have to complete 3 courses
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
11APM	**Applied Mathematics**	ZK				P
15JAA	**Foreign Language - English**	ZK				P
17LOGI	**Logistics**	ZK				P

Characteristics of the courses of this group of Study Plan: Code=D-P-L-25 Name=Compulsory courses Ph.D. L from 25/26

11APM	Applied Mathematics	ZK	
Random processes and real applications Bayesian prediction model of stochastic system (distribution, equations) Continuous and discrete model - simulation of dynamical systems System state, state-space model, filtering (Kalman filter) Estimation of model parameters - Bayes relation, reproducibility, exponential family of distributions Estimation statistics of continuous and discrete model, on-line recalculation of statistics, point estimates Estimation of models with non-Gaussian or non-categorical distribution reproducibility, point estimates Prediction with Bayesian model Finite interval control, dynamic programming, Riccati equations, algorithmization Mixture models of distributions with continuous and discrete components, hierarchical mixtures Estimation of mixture of distributions Mixture estimation for clustering and classification Hierarchical mixture estimation Prediction with mixture model			
15JAA	Foreign Language - English	ZK	
17LOGI	Logistics	ZK	

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 0
The role of the block: PV

Code of the group: D-V-L-25
Name of the group: Compulsory elective courses Ph.D. L from 25/26
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
21ATML	**Air Traffic Management**	ZK				PV
17AITD	**Application of IT Technologies in Transport**	ZK				PV
17AMN	**Applied Marketing Tools**	ZK				PV
17EDTD	**Economics of Transport and Telecommunication**	ZK				PV
17FIMA	**Financial Management**	ZK				PV
14GEA	**Genetical and Evolutional Algorithms**	ZK				PV
20GEOI	**Geoinformation Engineering**	ZK				PV
14ITV	**Information Technologies in Transportation**	ZK				PV
17KND	**Cost Calculation in Transportation**	ZK				PV
17KBP	**Intermodal Transport**	ZK				PV
17KVD	**Transport Quality**	ZK				PV
17PMM	**Advanced methods of mathematical programming**	ZK				PV
17PMG	**Project Management**	ZK				PV
20RDSY	**Transport System Management**	ZK				PV
20SC	**Smart Cities**	ZK				PV
20SYAP	**System Analysis**	ZK				PV
17TZEL	**Technology of Railway Transport**	ZK				PV
17TRDL	**Theory of Transport**	ZK				PV

Characteristics of the courses of this group of Study Plan: Code=D-V-L-25 Name=Compulsory elective courses Ph.D. L from 25/26

21ATML	Air Traffic Management	ZK	

Air Traffic Management - theory, functions, strategic perspectives in the field of ATM and research questions Airspace Management - theory, functions, developments in ASM and research questions for near future Air Traffic Control - theory, functions, methods for calculating ATCos workload and for capacity of airspace, remote control Flight Information Service and Search and Rescue service - theory, functions, information flows between countries, new ways for Search and Rescue service Air Traffic Flow and Capacity Management - ATFCM - theory, functions, algorithms for flow and capacity management and their comparison Development in ATM - SES, NEXTGEN, FAB, projects philosophies, implementation, Free Route concept and route rescheduling ATM over oceans and remote areas - theory, functions, cooperation at the intercontinental level, transmission of flight plans ATM of airports - theory, functions, flow modelling, control tools, methods for analysis and simulation, synchronization of airport slots with ATM slots ATM concepts - RNAV, RNP, RNP APCH, PBN, Free route, Free flight, 4D navigation, integration of unmanned systems into ATM, and ATM and UTM coordination ATM and ANS of the future - theories, concepts for the future, concepts of spacing management between aircraft, increasing safety in ATM

17AITD	Application of IT Technologies in Transport	ZK	

Practical use of data to streamline processes in organizations Planning and implementation of a specific project Concluding a project contract Data mining - practical use Presentation of results for middle and top management Big data - possible solutions Coherence of data with mathematical statistics IT technology and legislation IT security

17AMN	Applied Marketing Tools	ZK	

Currently used tools in the field of marketing Selection of current areas of the applied marketing as energy saving products, social media, transport projects, education, financial products and public affairs marketing Practical demonstrations and creation of projects with regard to target groups and marketing tools used

17EDTD	Economics of Transport and Telecommunication	ZK	

The subject is dedicated to analytical and synthetically views of economic activities, both the production and services business systems. The main interest is focused on the parts which will be provided in decision-making processes by future engineers, technologists and managers. The property and financial structures create the basic issues for business activities. Furthermore, the attention is concentrated on time life cycle of product and service, quantification economic time life, depreciation and methods of its calculation. The problem of inventories as a key question of business activities is provided and basic mathematical inventory models are given. The core of entrepreneurial process - cost analysis, cost estimating , revenue, profit and benefit are put to the main interest of engineer and manager together with structure of business plan, entrepreneurial projects and their analysis and evaluation. Finally, the characteristics of time life business cycle from the start of activities to the end these ones are discussed. The position of transport in the system of the national economy Macroeconomic models Transport infrastructure, transport and telecommunications operation Multiplicative effects of transport infrastructure Trading with products in transport and telecommunications Cost calculation, pricing and tariffs creation Qualitative factors of transport systems Economic - energy aspects of transport systems Transport and environment, theory of externalities Infrastructure operation, public sector theory Services in the public interest Principles of transport services in the area Transport and telecommunications companies, choice of company type, its establishment and operation Economic principles of evaluation of transport projects

17FIMA	Financial Management	ZK	
14GEA	Genetical and Evolutional Algorithms	ZK	

Optimization, problem classes (P, NP, NP-complete) Darwins, Baldwin's and Lamarck's evolutionary theories, evolutional technique principles Genetic algorithms Fitness function and its modifications Selection principles Evolution strategy Differential evolution Grammatical evolution Genetic programming GPA SOMA Applications of evolutional techniques Simulated annealing GP and GA in machinery learning

20GEOI	Geoinformation Engineering	ZK	

the basis of the structure of the storage of spatially oriented information geometric reflection the types of formats of storage of spatially oriented information layers, shapefiles, geodatabases the structure and the requirements of attribute tables minimum from surveying minimum from cartography basic tasks of spatial operations simple operations basic tasks of spatial operations composite operations spatial modeling acquisition of geoknowledges principles of territorial identification the specialized geoportal ČÚZK network sources of spatially oriented data and their use linear reference and dynamic segmentation job solutions

14ITV	Information Technologies in Transportation	ZK	

Flight planning and flight planning software EFB Aircraft performance software Electronic loadsheet Preflight and postflight analysis software Software for Airline Management Eurocontrol software Software using for CDM process Aircraft and passenger handling software ACARS - principles and application ATC systems Flight watch systems AFTN, SITA principles and applications Safety and Security information systems

17KND	Cost Calculation in Transportation	ZK	

Legislation related to cost calculation Basic terms (calculation formulas, unit costs) Cost categories (accounting, management, for calculation purposes) Indirect costs (structure, allocation) Cost calculation in public transportation (brutto/netto contracts, public transportation financing, subsidies, compensations, fare discounts) Cost calculation software Case studies (road, rail, water and air transportation)

17KBP	Intermodal Transport	ZK	

· Principles, visions and goals of Common Transport Policy of the EU and Czech republic · Intergovernmental organizations in freight transport · International organizations in freight transport · FIATA, Association of forwarding and logistics of the Czech republic · Customs transit procedures, Customs convention TIR · Domestic carriage and forwarding · International freight carriage · Carriage relations in intermodal transport · Technology in intermodal transport · Technics in intermodal transport · Carriage relations in forwarding · Transport networks, optimal connection by means of intermodal transport · Optimal service of spokes and hubs of intermodal transport and location of terminals · Collection and utilization of intermodal units

17KVD	Transport Quality	ZK	

Theoretical conception of quality Standards and international standardization Integrated management systems Modern approach to quality management Transport quality Quality management Technical and technological quality Methods of quality measurement Risks, opportunities, quality touchstones Quality cycle Methodology of EN 13816, CSS, DPM, MSS Quality standards, ZZZ requirement Quality costs Marketing and quality

17PMM	Advanced methods of mathematical programming	ZK	

Linear programming methods for solving optimization problems with one criterion (simplex method, branch and bound method, Gomory algorithms, column generation method, Benders decomposition method, sensitivity analysis) Linear programming methods for solving optimization problems with multiple criteria (scalarization method, sequential optimization according to criteria preference, STEM, criteria aggregation method) Nonlinear programming methods for solving optimization problems with one criterion without relations (gradient methods, Davidon-Fletcher-Powell method) Nonlinear programming methods for solving optimization problems with one criterion and with relations (Lagrange multipliers method, reduced gradient methods - Wolfe's method). Transformation of nonlinear optimization models into linear models. Multilevel mathematical programming Dynamic programming Compromise and composite programming Goal programming

17PMG	Project Management	ZK	

Economic system, investment, planning Investment project preparation, project typical scheme Uncontrollable externalities causing the collapse of the project , project with uncertainty Project study, content and goals Feasibility study (content) Feasibility study network graph Project manager, characteristics and responsibilities Project communication Line management vs. Project management SW project support, SW tools Project management processes Project plan, administrative capacity Project costs, budgeting methods Project control, project change management EIA (Environmental Impact Assessment) Spatial planning, construction law

20RDSY	Transport System Management	ZK	

Design of traffic control algorithms in urban and urban areas. Traffic technologies and systems, tunnels and systems for multimodal transport, autonomous systems and other ITS solutions. Transport alliances, agent systems. Legislation and standardization in the field of traffic management. Introduction and basic concepts and architecture of control systems, basic classification Advanced detection systems and forms of communication systems Management and information systems in the city - principles of management Algorithms for traffic optimization and incident detection in urban areas Public transport preferences, parking systems, penalization systems, Sustainable mobility in cities and agglomerations - simulation Highway control and information systems Toll systems - classification description, principles Incident detection algorithms, HW and SW tools - simulation Tunnel systems - technological elements, control, reliability and safety, Autonomous control systems - intelligent vehicle, Cooperative systems Railway control systems Management systems in air and water transport Standardization, norms and new trends and approaches in management traffic systems

20SC	Smart Cities	ZK	

The aim of the course is to present a systemic view of the issue of smart cities (Smart Cities) so that the resources used (land takeover, energy, etc.) are minimized and existing infrastructure (transport, energy, data, etc.) is maximized. Furthermore, partial technologies used in solving the issue of smart cities will be presented from the point of view of basic principles, conditions of use and possibilities of integration into superstructure components. 1. Introduction to the issue of smart cities (historical development, basic terminology, organizations dealing with the issue of smart cities and their contribution to the development of the whole field). 2. Information technology (FOG, CLOUD, IoT, satellite technology). 3. System description of smart city (functional and information architecture, identification of sub-components, interface specifications, definition of strong processes, technical standards - CEN, ISO, IEEE, etc.) . 4. Smart city data platform (data collection, transmission and processing, sensor networks, Internet of Things - IoT, ontological data model of smart city, open data, sample of existing data platforms of cities). 5. Technologies for description and simulation of processes (transport, energy, environment) including virtual and augmented reality (software tools, examples of use). 6. Smart mobility (SUMP - Sustainable urban mobility plans, MaaS - Mobility as a service, C-ITS - Co-operative intelligent transportation systems, nové typy dopravních prostředků, chytrá city logistika). 7. Smart energy (smart meters, EaaS - Energy as a service, smart grids , renewable energy sources, smart appliances, smart energy storage, electromobility). 8. Smart lighting (categorization of illuminated urban infrastructure, minimization of energy costs and maintenance costs of urban lighting, lighting as the backbone communication and sensory infrastructure of a smart city, integration of lighting and other functions - SOS, charging infrastructure, camera system, etc.) . 9. System integration of sub-components of smart city (tools for system integration - SysML, ASN.1, MAS). 10. Smart street, square, district (example of integration of partial components including evaluation of economic costs and benefits). 11. Human dimension of smart city (HMI interface, use of virtual and augmented reality, communication with users of smart solutions, new economic models). 12. Legislative issues of smart city (Personal data protection - GDPR, Intellectual property law - IPR, determination of liability - liability, responsibility). 13. Smart city rating (Smart City Index according to ISO 37210, example of smartness rating of individual cities). 14. Examples of smart city implementation (EU, China, India, Africa, USA).

20SYAP	System Analysis	ZK	
17TZEL	Technology of Railway Transport	ZK	

Research Methods of Causal Relationships of Demand Elasticity on Supply Planning in Railway Transport Organization and management of technological processes in rail passenger and freight transport Operational modelling of freight transport paths, stochastic control ATO-system AVV, interaction of AVV and ETCS systems Minimum headways safety distances, points of possible mutual danger, factors influencing the length of minimum headways, Methods for determining track capacity, collision point theory, performance of the railway system as a whole Methods of optimising capacity and throughput, relationship between capacity and quality of service Timetable elements, UIC methodology, path´s heterogeneity Arrangement of simple IPT- junctions Timetable stability, critical section for determining stability, possible solutions in case of insufficient timetable stability Methods for optimising operational processes in relation to infrastructure capacity Methods of solving the interaction between traffic, infrastructure and means of transport Operational management of railway traffic, optimisation methods, strategies and disposition objectives Modelling of technological processes on available and proposed transport infrastructure

17TRDL	Theory of Transport	ZK	

Paths in undirected graphs Paths in directed graphs Minimum spanning trees, Eulerian and Hamiltonian graphs Traveling salesman problem, Vehicle routing problem, heuristic methods Network flow Graph planarity Graph coloring Trees Assignment problem Location and allocation problems Discrete location problems Continuous location problems Discrete optimization problems and their solution Application of genetic algorithms to discrete optimization problems Selected topics from mathematical optimization of transportation problems

Name of the block: Jazyky
Minimal number of credits of the block: 0
The role of the block: J

Code of the group: D-J-L-25
Name of the group: Second language Ph.D. L from 25/26
Requirement credits in the group:

Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
15JAF	**Foreign Language - French**	Z				J
15JAN	**Foreign Language - German**	Z				J
15JAR	**Foreign Language - Russian**	Z				J
15JAS	**Foreign Language - Spanish**	Z				J

Characteristics of the courses of this group of Study Plan: Code=D-J-L-25 Name=Second language Ph.D. L from 25/26

15JAF	Foreign Language - French	Z	

Introductory lecture. Literature, Internet sources. Revision of the most important grammar parts. Professional texts grammatical, lexical and stylistic characteristics. Public transport. Paris x Prague. Underground. Trams in France. Rail transport. Records of TGV. Air transport. Air fleet. Road transport. Motorways, toll. Transport safety. Terminology of the selected study area, specific terminology in French. Translation of professional texts. Consultation for the presentation of doctoral thesis - spelling, lexical and stylistic arrangement Written presentation of doctoral thesis, summary, discussion. Oral presentation of a professional article from the area of transport The course has a form of consultation hours during a period of two semesters. A precondition for receiving the credit is mastering of basic grammar and terminology needed for presentations of independent work within the field of one's specialisation, such as reading specialised texts and submitting a resume of dissertation thesis.

15JAN	Foreign Language - German	Z	

Research, work with German search engines. Main grammatical structures, their practical application in particular texts verb forms, Participle. Main grammatical structures, their practical application in particular texts sentence structure Stylistic and lexical features of professional language, text work. Usage of passive in professional texts. Work with professional texts, text structure, presentation of professional contents. Specific language means in description of graphs. Translation of professional texts examples from the study area. Vocabulary of specific professional terms, comparison of Czech and German terminology of the given study area Preparation of presentation of student´s own doctoral thesis. Written presentation of the doctoral thesis. Oral presentation of the doctoral thesis in PowerPoint. Individual presentation with a professional topic Summary The course has a form of consultation hours during a period of two semesters. A precondition for receiving the credit is mastering of basic grammar and terminology needed for presentations of independent work within the field of one's specialisation, such as reading specialised texts and submitting a resume of dissertation thesis.

15JAR	Foreign Language - Russian	Z	

Research, work with Russian search engines. Main grammatical structures, test sources, their application verb forms. Main grammatical structures, test sources, their application sentence structure, inflection. Stylistic features of professional language, text work. Usage of passive in professional texts. Individual presentation of professional texts practice. Specific language means, graph description, lexical means of written professional text. Translation of professional texts practice. Creation of database of specific professional terms, comparison of Czech and Russian terminology of the given area. Syntactic-semantic structure with presentation of a professional work (prepared sources and their practical application). Written presentation of the prepared doctoral work. Oral presentation of the doctoral work in PowerPoint. Individual presentation with a professional topic. The course has a form of consultation hours during a period of two semesters. A precondition for receiving the credit is mastering of basic grammar and terminology needed for presentations of independent work within the field of one's specialisation, such as reading specialised texts and submitting a resume of dissertation thesis.

15JAS	Foreign Language - Spanish	Z	

Introducción. Presente. / Introductory lecture. Present simple. Medios de transporte. / Transport means. Futuro. Perífrasis ir a + inf./ Future tense. Phrase ir a + inf. Transporte en la República Checa. / Transport in the Czech Republic. Pretérito perfecto compuesto. / Past tense perfect. Transporte en España e Iberoamérica. / Transport in Spain and Latin America. Pretérito perfecto imperfecto. / Past tense continuous. Política de transporte de la UE. / Transport politics in the EU. Pretérito perfecto simple. / Past simple. Accidentes. / Accidents. Curiosidades. / Interesting facts in transport. CV. Carta de motivación. / CV. Letter of motivation. Repaso. / Repetition. Presentación + examen. / Presentation + written test.

List of courses of this pass:

Code	Name of the course	Completion	Credits
11APM	Applied Mathematics	ZK	

Random processes and real applications Bayesian prediction model of stochastic system (distribution, equations) Continuous and discrete model - simulation of dynamical systems System state, state-space model, filtering (Kalman filter) Estimation of model parameters - Bayes relation, reproducibility, exponential family of distributions Estimation statistics of continuous and discrete model, on-line recalculation of statistics, point estimates Estimation of models with non-Gaussian or non-categorical distribution reproducibility, point estimates Prediction with Bayesian model Finite interval control, dynamic programming, Riccati equations, algorithmization Mixture models of distributions with continuous and discrete components, hierarchical mixtures Estimation of mixture of distributions Mixture estimation for clustering and classification Hierarchical mixture estimation Prediction with mixture model

14GEA	Genetical and Evolutional Algorithms	ZK	

Optimization, problem classes (P, NP, NP-complete) Darwins, Baldwin's and Lamarck's evolutionary theories, evolutional technique principles Genetic algorithms Fitness function and its modifications Selection principles Evolution strategy Differential evolution Grammatical evolution Genetic programming GPA SOMA Applications of evolutional techniques Simulated annealing GP and GA in machinery learning

14ITV	Information Technologies in Transportation	ZK	

Flight planning and flight planning software EFB Aircraft performance software Electronic loadsheet Preflight and postflight analysis software Software for Airline Management Eurocontrol software Software using for CDM process Aircraft and passenger handling software ACARS - principles and application ATC systems Flight watch systems AFTN, SITA principles and applications Safety and Security information systems

15JAA	Foreign Language - English	ZK	
15JAF	Foreign Language - French	Z	

Introductory lecture. Literature, Internet sources. Revision of the most important grammar parts. Professional texts grammatical, lexical and stylistic characteristics. Public transport. Paris x Prague. Underground. Trams in France. Rail transport. Records of TGV. Air transport. Air fleet. Road transport. Motorways, toll. Transport safety. Terminology of the selected study area, specific terminology in French. Translation of professional texts. Consultation for the presentation of doctoral thesis - spelling, lexical and stylistic arrangement Written presentation of doctoral thesis, summary, discussion. Oral presentation of a professional article from the area of transport The course has a form of consultation hours during a period

	of two semesters. A precondition for receiving the credit is mastering of basic grammar and terminology needed for presentations of independent work within the field of one's specialisation, such as reading specialised texts and submitting a resume of dissertation thesis.		
15JAN	Foreign Language - German	Z	
	Research, work with German search engines. Main grammatical structures, their practical application in particular texts verb forms, Participle. Main grammatical structures, their practical application in particular texts sentence structure Stylistic and lexical features of professional language, text work. Usage of passive in professional texts. Work with professional texts, text structure, presentation of professional contents. Specific language means in description of graphs. Translation of professional texts examples from the study area. Vocabulary of specific professional terms, comparison of Czech and German terminology of the given study area Preparation of presentation of student´s own doctoral thesis. Written presentation of the doctoral thesis. Oral presentation of the doctoral thesis in PowerPoint. Individual presentation with a professional topic Summary The course has a form of consultation hours during a period of two semesters. A precondition for receiving the credit is mastering of basic grammar and terminology needed for presentations of independent work within the field of one's specialisation, such as reading specialised texts and submitting a resume of dissertation thesis.		
15JAR	Foreign Language - Russian	Z	
	Research, work with Russian search engines. Main grammatical structures, test sources, their application verb forms. Main grammatical structures, test sources, their application sentence structure, inflection. Stylistic features of professional language, text work. Usage of passive in professional texts. Individual presentation of professional texts practice. Specific language means, graph description, lexical means of written professional text. Translation of professional texts practice. Creation of database of specific professional terms, comparison of Czech and Russian terminology of the given area. Syntactic-semantic structure with presentation of a professional work (prepared sources and their practical application). Written presentation of the prepared doctoral work. Oral presentation of the doctoral work in PowerPoint. Individual presentation with a professional topic. The course has a form of consultation hours during a period of two semesters. A precondition for receiving the credit is mastering of basic grammar and terminology needed for presentations of independent work within the field of one's specialisation, such as reading specialised texts and submitting a resume of dissertation thesis.		
15JAS	Foreign Language - Spanish	Z	
	Introducción. Presente. / Introductory lecture. Present simple. Medios de transporte. / Transport means. Futuro. Perífrasis ir a + inf./ Future tense. Phrase ir a + inf. Transporte en la República Checa. / Transport in the Czech Republic. Pretérito perfecto compuesto. / Past tense perfect. Transporte en España e Iberoamérica. / Transport in Spain and Latin America. Pretérito perfecto imperfecto. / Past tense continuous. Política de transporte de la UE. / Transport politics in the EU. Pretérito perfecto simple. / Past simple. Accidentes. / Accidents. Curiosidades. / Interesting facts in transport. CV. Carta de motivación. / CV. Letter of motivation. Repaso. / Repetition. Presentación + examen. / Presentation + written test.		
17AITD	Application of IT Technologies in Transport	ZK	
	Practical use of data to streamline processes in organizations Planning and implementation of a specific project Concluding a project contract Data mining - practical use Presentation of results for middle and top management Big data - possible solutions Coherence of data with mathematical statistics IT technology and legislation IT security		
17AMN	Applied Marketing Tools	ZK	
	Currently used tools in the field of marketing Selection of current areas of the applied marketing as energy saving products, social media, transport projects, education, financial products and public affairs marketing Practical demonstrations and creation of projects with regard to target groups and marketing tools used		
17EDTD	Economics of Transport and Telecommunication	ZK	
	The subject is dedicated to analytical and synthetically views of economic activities, both the production and services business systems. The main interest is focused on the parts which will be provided in decision-making processes by future engineers, technologists and managers. The property and financial structures create the basic issues for business activities. Furthermore, the attention is concentrated on time life cycle of product and service, quantification economic time life, depreciation and methods of its calculation. The problem of inventories as a key question of business activities is provided and basic mathematical inventory models are given. The core of entrepreneurial process - cost analysis, cost estimating , revenue, profit and benefit are put to the main interest of engineer and manager together with structure of business plan, entrepreneurial projects and their analysis and evaluation. Finally, the characteristics of time life business cycle from the start of activities to the end these ones are discussed. The position of transport in the system of the national economy Macroeconomic models Transport infrastructure, transport and telecommunications operation Multiplicative effects of transport infrastructure Trading with products in transport and telecommunications Cost calculation, pricing and tariffs creation Qualitative factors of transport systems Economic - energy aspects of transport systems Transport and environment, theory of externalities Infrastructure operation, public sector theory Services in the public interest Principles of transport services in the area Transport and telecommunications companies, choice of company type, its establishment and operation Economic principles of evaluation of transport projects		
17FIMA	Financial Management	ZK	
17KBP	Intermodal Transport	ZK	
	· Principles, visions and goals of Common Transport Policy of the EU and Czech republic · Intergovernmental organizations in freight transport · International organizations in freight transport · FIATA, Association of forwarding and logistics of the Czech republic · Customs transit procedures, Customs convention TIR · Domestic carriage and forwarding · International freight carriage · Carriage relations in intermodal transport · Technology in intermodal transport · Technics in intermodal transport · Carriage relations in forwarding · Transport networks, optimal connection by means of intermodal transport · Optimal service of spokes and hubs of intermodal transport and location of terminals · Collection and utilization of intermodal units		
17KND	Cost Calculation in Transportation	ZK	
	Legislation related to cost calculation Basic terms (calculation formulas, unit costs) Cost categories (accounting, management, for calculation purposes) Indirect costs (structure, allocation) Cost calculation in public transportation (brutto/netto contracts, public transportation financing, subsidies, compensations, fare discounts) Cost calculation software Case studies (road, rail, water and air transportation)		
17KVD	Transport Quality	ZK	
	Theoretical conception of quality Standards and international standardization Integrated management systems Modern approach to quality management Transport quality Quality management Technical and technological quality Methods of quality measurement Risks, opportunities, quality touchstones Quality cycle Methodology of EN 13816, CSS, DPM, MSS Quality standards, ZZZ requirement Quality costs Marketing and quality		
17LOGI	Logistics	ZK	
17PMG	Project Management	ZK	
	Economic system, investment, planning Investment project preparation, project typical scheme Uncontrollable externalities causing the collapse of the project , project with uncertainty Project study, content and goals Feasibility study (content) Feasibility study network graph Project manager, characteristics and responsibilities Project communication Line management vs. Project management SW project support, SW tools Project management processes Project plan, administrative capacity Project costs, budgeting methods Project control, project change management EIA (Environmental Impact Assessment) Spatial planning, construction law		
17PMM	Advanced methods of mathematical programming	ZK	
	Linear programming methods for solving optimization problems with one criterion (simplex method, branch and bound method, Gomory algorithms, column generation method, Benders decomposition method, sensitivity analysis) Linear programming methods for solving optimization problems with multiple criteria (scalarization method, sequential optimization according to criteria preference, STEM, criteria aggregation method) Nonlinear programming methods for solving optimization problems with one criterion without relations (gradient methods, Davidon-Fletcher-Powell method) Nonlinear programming methods for solving optimization problems with one criterion and with relations (Lagrange multipliers method, reduced gradient methods - Wolfe's method). Transformation of nonlinear optimization models into linear models. Multilevel mathematical programming Dynamic programming Compromise and composite programming Goal programming		
17TRDL	Theory of Transport	ZK	
	Paths in undirected graphs Paths in directed graphs Minimum spanning trees, Eulerian and Hamiltonian graphs Traveling salesman problem, Vehicle routing problem, heuristic methods Network flow Graph planarity Graph coloring Trees Assignment problem Location and allocation problems Discrete location problems Continuous location problems Discrete optimization problems and their solution Application of genetic algorithms to discrete optimization problems Selected topics from mathematical optimization of transportation problems		

17TZEL	Technology of Railway Transport	ZK	
Research Methods of Causal Relationships of Demand Elasticity on Supply Planning in Railway Transport Organization and management of technological processes in rail passenger and freight transport Operational modelling of freight transport paths, stochastic control ATO-system AVV, interaction of AVV and ETCS systems Minimum headways safety distances, points of possible mutual danger, factors influencing the length of minimum headways, Methods for determining track capacity, collision point theory, performance of the railway system as a whole Methods of optimising capacity and throughput, relationship between capacity and quality of service Timetable elements, UIC methodology, path´s heterogeneity Arrangement of simple IPT- junctions Timetable stability, critical section for determining stability, possible solutions in case of insufficient timetable stability Methods for optimising operational processes in relation to infrastructure capacity Methods of solving the interaction between traffic, infrastructure and means of transport Operational management of railway traffic, optimisation methods, strategies and disposition objectives Modelling of technological processes on available and proposed transport infrastructure			
20GEOI	Geoinformation Engineering	ZK	
the basis of the structure of the storage of spatially oriented information geometric reflection the types of formats of storage of spatially oriented information layers, shapefiles, geodatabases the structure and the requirements of attribute tables minimum from surveying minimum from cartography basic tasks of spatial operations simple operations basic tasks of spatial operations composite operations spatial modeling acquisition of geoknowledges principles of territorial identification the specialized geoportal ČÚZK network sources of spatially oriented data and their use linear reference and dynamic segmentation job solutions			
20RDSY	Transport System Management	ZK	
Design of traffic control algorithms in urban and urban areas. Traffic technologies and systems, tunnels and systems for multimodal transport, autonomous systems and other ITS solutions. Transport alliances, agent systems. Legislation and standardization in the field of traffic management. Introduction and basic concepts and architecture of control systems, basic classification Advanced detection systems and forms of communication systems Management and information systems in the city - principles of management Algorithms for traffic optimization and incident detection in urban areas Public transport preferences, parking systems, penalization systems, Sustainable mobility in cities and agglomerations - simulation Highway control and information systems Toll systems - classification description, principles Incident detection algorithms, HW and SW tools - simulation Tunnel systems - technological elements, control, reliability and safety, Autonomous control systems - intelligent vehicle, Cooperative systems Railway control systems Management systems in air and water transport Standardization, norms and new trends and approaches in management traffic systems			
20SC	Smart Cities	ZK	
The aim of the course is to present a systemic view of the issue of smart cities (Smart Cities) so that the resources used (land takeover, energy, etc.) are minimized and existing infrastructure (transport, energy, data, etc.) is maximized. Furthermore, partial technologies used in solving the issue of smart cities will be presented from the point of view of basic principles, conditions of use and possibilities of integration into superstructure components. 1. Introduction to the issue of smart cities (historical development, basic terminology, organizations dealing with the issue of smart cities and their contribution to the development of the whole field). 2. Information technology (FOG, CLOUD, IoT, satellite technology). 3. System description of smart city (functional and information architecture, identification of sub-components, interface specifications, definition of strong processes, technical standards - CEN, ISO, IEEE, etc.) . 4. Smart city data platform (data collection, transmission and processing, sensor networks, Internet of Things - IoT, ontological data model of smart city, open data, sample of existing data platforms of cities). 5. Technologies for description and simulation of processes (transport, energy, environment) including virtual and augmented reality (software tools, examples of use). 6. Smart mobility (SUMP - Sustainable urban mobility plans, MaaS - Mobility as a service, C-ITS - Co-operative intelligent transportation systems, nové typy dopravních prostředků, chytrá city logistika). 7. Smart energy (smart meters, EaaS - Energy as a service, smart grids , renewable energy sources, smart appliances, smart energy storage, electromobility). 8. Smart lighting (categorization of illuminated urban infrastructure, minimization of energy costs and maintenance costs of urban lighting, lighting as the backbone communication and sensory infrastructure of a smart city, integration of lighting and other functions - SOS, charging infrastructure, camera system, etc.) . 9. System integration of sub-components of smart city (tools for system integration - SysML, ASN.1, MAS). 10. Smart street, square, district (example of integration of partial components including evaluation of economic costs and benefits). 11. Human dimension of smart city (HMI interface, use of virtual and augmented reality, communication with users of smart solutions, new economic models). 12. Legislative issues of smart city (Personal data protection - GDPR, Intellectual property law - IPR, determination of liability - liability, responsibility). 13. Smart city rating (Smart City Index according to ISO 37210, example of smartness rating of individual cities). 14. Examples of smart city implementation (EU, China, India, Africa, USA).			
20SYAP	System Analysis	ZK	
21ATML	Air Traffic Management	ZK	
Air Traffic Management - theory, functions, strategic perspectives in the field of ATM and research questions Airspace Management - theory, functions, developments in ASM and research questions for near future Air Traffic Control - theory, functions, methods for calculating ATCos workload and for capacity of airspace, remote control Flight Information Service and Search and Rescue service - theory, functions, information flows between countries, new ways for Search and Rescue service Air Traffic Flow and Capacity Management - ATFCM - theory, functions, algorithms for flow and capacity management and their comparison Development in ATM - SES, NEXTGEN, FAB, projects philosophies, implementation, Free Route concept and route rescheduling ATM over oceans and remote areas - theory, functions, cooperation at the intercontinental level, transmission of flight plans ATM of airports - theory, functions, flow modelling, control tools, methods for analysis and simulation, synchronization of airport slots with ATM slots ATM concepts - RNAV, RNP, RNP APCH, PBN, Free route, Free flight, 4D navigation, integration of unmanned systems into ATM, and ATM and UTM coordination ATM and ANS of the future - theories, concepts for the future, concepts of spacing management between aircraft, increasing safety in ATM			

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