Study plan

Name of study plan: Master Full-Time IS (CS) from 2024/25

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Intelligent Transport Systems
Type of study: Follow-up master full-time
Required credits: 76
Elective courses credits: 44
Sum of credits in the plan: 120
Note on the plan:

Name of the block: Compulsory courses
Minimal number of credits of the block: 49
The role of the block: Z

Code of the group: 1S-NP-IS-CS-24/25
Name of the group: 1st Sem. Master Full-Time IS (CS) from 2024/25
Requirement credits in the group: In this group you have to gain 22 credits
Requirement courses in the group: In this group you have to complete 5 courses
Credits in the group: 22
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
11MAI	**ITS Mathematical Tools** *Jan Přikryl* ***Jan Přikryl*** *Jan Přikryl (Gar.)*	Z,ZK	4	2P+2C	Z	z
16DITS	**Vehicles within ITS** *Jan Leistner, Filip Kotas, David Lehet, Jaroslav Machan*	Z,ZK	4	2P+2C	Z	z
20GINS	**Geographical, information, localization and navigation systems** *Pavel Hrubeš, Petr Bureš, Zuzana Purkrábková, František Kekula* ***Pavel Hrubeš***	Z,ZK	6	3P+3C	Z	z
20TSJ	**Telematic systems and their design** *Pavel Hrubeš, Martin Langr* ***Martin Langr***	Z,ZK	6	3P+2C	Z	z
20TBSS	**Technology and Security of Sensor Networks** *Zdeněk Lokaj, Tomáš Tichý, Miroslav Vaniš, Jiří Brož* ***Zdeněk Lokaj*** *Zdeněk Lokaj (Gar.)*	KZ	2	2P+0C	Z	z

Characteristics of the courses of this group of Study Plan: Code=1S-NP-IS-CS-24/25 Name=1st Sem. Master Full-Time IS (CS) from 2024/25

11MAI	ITS Mathematical Tools	Z,ZK	4
Series, Fourier Series. Discrete Fourier Transform. Segmentation of signals, windows, localization. Short-term Fourier Transform. From Fourier Analysis to PDE. Fundamentals of Numerical Mathematics. Numerical solutions to ODEs and PDEs. Continuous traffic flow models described by PDE. Car-following models as ODEs.			
16DITS	Vehicles within ITS	Z,ZK	4
Design of the vehicle with focus on its use and function in frame of ITS. User requirement analyses. Economic aspects. Process of constructions in a concept phase, functional dependences and structure of the designed object. Creation of functional models. Energy management and storages for ground vehicles, energy transformations leading to kinetic one. Propulsion systems / traditional and alternative ones. Life-cycle analysis.			
20GINS	Geographical, information, localization and navigation systems	Z,ZK	6
The subject is specialized in problems of work with applications of geographic information systems with special attention to the specialization in the field of transport and telecommunication. It introduces students to geographic data management practices and tools, real world modeling, geographic data storage models, data entry and digitization methods, and a number of other GIS related technologies such as problem mapping, webmap, etc.			
20TSJ	Telematic systems and their design	Z,ZK	6
Gradual detailed analysis of individual existing telematics systems in modes of transport, such as toll systems, vehicle weighing, fleet management, traffic management, etc.			
20TBSS	Technology and Security of Sensor Networks	KZ	2
Basic concepts of safety and reliability in transport and its application. Basic scheme and types of diagnostic systems, including reliability diagnostics of technological equipment and ITS. Investigation of the area of acceptability and prediction of reliability, sensitivity in transport and sensitivity analysis. Neural networks and other optimization algorithms and fault analysis ETA, FMEA. HMI in transport, including operator testing on a simulator and in real situations.			

Code of the group: 1S-NP-IS-CS-V-20/21

Name of the group: 1st Sem. Master Full-Time IS (CS) Alternative from 2020/21
Requirement credits in the group: In this group you have to gain 3 credits
Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 3
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
12TDP	**Traffic Flow Theory** *Vladimír Faltus*	Z,ZK	3	2P+1C	Z	z
16ESDP	**Electronic systems in modern vehicles** *Petr Bouchner, Dmitrij Rožděstvenský*	Z,ZK	3	2P+1C	Z	z
20MZZ	**Modern techniques of safety control of moving railway vehicles** *Martin Leso **Martin Leso***	Z,ZK	3	2P+1C	Z	z

Characteristics of the courses of this group of Study Plan: Code=1S-NP-IS-CS-V-20/21 Name=1st Sem. Master Full-Time IS (CS) Alternative from 2020/21

12TDP	Traffic Flow Theory	Z,ZK	3
Mobility and associated human problems. Basic traffic parameters and their measurement. Estimation of quality of services. Theoretical fundamentals and applications of mathematical models. Macroscopic, statistical and microscopic models. Theory of shock waves, queuing theory and special theory of traffic phenomena. Relation between traffic models and traffic flow management.			
16ESDP	Electronic systems in modern vehicles	Z,ZK	3
Advanced vehicle systems, electromobility, V2I and V2V, autonomous driving. Combustion engine control and electronic control units. Electric propulsion, its components, basic characteristics and control. Management of hybrid propulsion for attaining its optimal efficiency. Vehicle communication bus (CAN, LIN, FlexRay etc.). Safety, communication and comfort electronic vehicle systems. Practical exercises with real and simulated systems.			
20MZZ	Modern techniques of safety control of moving railway vehicles	Z,ZK	3
ERTMS / ETCS concepts, ETCS architecture and interface descriptions, ERTMS system level, infrastructure and mobile part of the system, linking to stationary security systems, operating and application modes of the system, infrastructure orientation, interface (DMI), integration of the ETCS mobile part into the driving vehicle, GSM-R functional specification, testing and legislation.			

Code of the group: 2S-NP-IS-CS-20/21
Name of the group: 2nd Sem. Master Full-Time IS (CS) from 2020/21
Requirement credits in the group: In this group you have to gain 21 credits
Requirement courses in the group: In this group you have to complete 5 courses
Credits in the group: 21
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
14CITS	**C-ITS Systems** *Zdeněk Lokaj, Miroslav Vaniš, Tomáš Zelinka **Zdeněk Lokaj** Zdeněk Lokaj (Gar.)*	Z,ZK	6	3P+3C	L	z
14PAM	**Programming and modelling** *Vít Fábera, Tomáš Brandejský, Marek Kalika, Martin Fiala **Vít Fábera** Vít Fábera (Gar.)*	Z,ZK	4	2P+2C	L	z
14PD	**Data processing** *Miroslav Vaniš, Martin Šrotýř, Michal Jeřábek **Martin Šrotýř** Martin Šrotýř (Gar.)*	Z,ZK	6	2P+4C	L	z
14PPRP	**Computer Aided Project Management** *Marek Kalika **Marek Kalika** Marek Kalika (Gar.)*	KZ	2	0P+2C	L	z
20BITS	**Safety and reliability of ITS Systems** *Tomáš Tichý, Vladimír Faltus*	KZ	3	2P+1C	L	z

Characteristics of the courses of this group of Study Plan: Code=2S-NP-IS-CS-20/21 Name=2nd Sem. Master Full-Time IS (CS) from 2020/21

14CITS	C-ITS Systems	Z,ZK	6
Detailed description of C-ITS systems architecture, description of use-cases - urban and rural applications, principles of C-ITS funcionality with focus on data exchange (CAM, DENM, IVI) and C-ITS security architecture. Status quo and modern trends of wireless telecommunication solutions ITS-G5 and LTE-V and description of its properties and specifics. Course will also cover signal processing.			
14PAM	Programming and modelling	Z,ZK	4
Object oriented programming, dynamic memory allocation, inheritage, generic programming, STL, abstract data types, programming techniques, recursion, complexity, Lindenmeyer's grammars, paralism in nature and in real systems, paralel computer systems, paralel programming, discrete simulation, models of processes, model types As-Is a To-Be, acquisition of analytical sources for modelling, BPMN language, SW Bizagi, model creation and life cycle.			
14PD	Data processing	Z,ZK	6
Students will learn about tools for data processing and analysis, using practical examples to try out the most common options used in data processing, including advanced options for presenting the results of analyses. In advanced methods, students will also perform specific analysis using Bayesian networks. Students will then independently perform data analysis on data from existing open systems.			

14PPRP	Computer Aided Project Management	KZ	2
What is the project? The basic terms a concepts of project management. Life cycle of the project and its phased approach. Analysis and specification of the assignment, activity definition, stages, objectives and measurability. Risk events and risk planning. Project change management during implementation. Preparation of the project outline (activities, restrictions, assignments, calendars etc.) Project planning and optimization - time, resources.			
20BITS	Safety and reliability of ITS Systems	KZ	3
The basic concepts of safety and reliability in the job and application. Basic schema and types of diagnostic systems including reliability diagnostics of technical equipment and ITS. Investigation of acceptability and reliability prediction, traffic crity and sensitivity analysis. Neural Networks and other optimization algorithms and ETA, FMEA failure analysis. HMI in traffic including operator testing on simulator and in real-world situatiation			

Code of the group: 2S-NP-IS-CS-V-20/21
Name of the group: 2nd Sem. Master Full-Time IS (CS) Alternative from 2020/21
Requirement credits in the group: In this group you have to gain 3 credits
Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 3
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
14MIM	**Microsimulation Models** *Jan Krčál* ***Jan Krčál*** *Jan Krčál (Gar.)*	KZ	3	0P+3C	L	Z
16SHMI	**Simulation and HMI** *Stanislav Novotný, Tereza Kunclová, Michal Cenkner*	Z,ZK	3	2P+1C	L	Z
20ITSR	**ITS - R** *Martin Leso Martin Leso (Gar.)*	Z,ZK	3	2P+1C	L	Z

Characteristics of the courses of this group of Study Plan: Code=2S-NP-IS-CS-V-20/21 Name=2nd Sem. Master Full-Time IS (CS) Alternative from 2020/21

14MIM	Microsimulation Models	KZ	3
Basic knowledge of traffic modeling and simulation will be broaded by the application of traffic control algorithms to traffic microsimulation models used in ITS. These include, for example, the proposal of algorithms for actuated signal control, pedestrian preference, dynamic network routing, road line traffic control, crossing security equipment, and PT preference. Algorithms will be designed, applied, and tested by students themselves.			
16SHMI	Simulation and HMI	Z,ZK	3
Simulation for the systems in transportation and vehicle systems. User interface, HMI (human-machine interaction), virtual reality and computer graphics for ITS. Simulation theory with application of computing equipment. Creating computing models. Mechanic and dynamic systems and their mathematical models. Simulation of vehicle dynamics, on-land carriage in particular. Virtual reality systems.			
20ITSR	ITS - R	Z,ZK	3
The introduction is devoted to description of the architecture and interface of the system with the ITS-R concept, the communication interface of the system, principles of ensuring functional and security features are defined. The principles of ERTMS / ETCS application level 3, UGTMS, CBTC are discussed in detail. Current and future communication technologies are described.			

Name of the block: Semestrální projekt
Minimal number of credits of the block: 27
The role of the block: ZP

Code of the group: X2-NP-IS-CS-20/21
Name of the group: Research Groups Master Full-Time IS (CS) from 2020/21
Requirement credits in the group: In this group you have to gain 27 credits
Requirement courses in the group: In this group you have to complete 4 courses
Credits in the group: 27
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
11XN1S	**Master project 1 for study programme IS**	Z	5	0P+4C	Z	ZP
12XN1S	**Master project 1 for study programme IS**	Z	5	0P+4C	Z	ZP
14XN1S	**Master project 1 for study programme IS** *Zdeněk Lokaj, Tomáš Zelinka, Martin Šrotýř*	Z	5	0P+4C	Z	ZP
15XN1S	**Master project 1 for study programme IS**	Z	5	0P+4C	Z	ZP
16XN1S	**Master project 1 for study programme IS** *Josef Mík, Milan Sliacky*	Z	5	0P+4C	Z	ZP
17XN1S	**Master project 1 for study programme IS**	Z	5	0P+4C	Z	ZP
18XN1S	**Master project 1 for study programme IS**	Z	5	0P+4C	Z	ZP

20XN1S	**Master project 1 for study programme IS** *Pavel Hrubeš, Jiří Brož, Martin Leso, Jiří Růžička*	Z	5	0P+4C	Z	ZP
21XN1S	**Master project 1 for study programme IS**	Z	5	0P+4C	Z	ZP
22XN1S	**Master project 1 for study programme IS**	Z	5	0P+4C	Z	ZP
23XN1S	**Master project 1 for study programme IS**	Z	5	0P+4C	Z	ZP
11XN2S	**Master project 2 for study programme IS**	Z	6	0P+4C	L	ZP
12XN2S	**Master project 2 for study programme IS**	Z	6	0P+4C	L	ZP
14XN2S	**Master project 2 for study programme IS** *Vít Fábera Vít Fábera (Gar.)*	Z	6	0P+4C	L	ZP
15XN2S	**Master project 2 for study programme IS**	Z	6	0P+4C	L	ZP
16XN2S	**Master project 2 for study programme IS**	Z	6	0P+4C	L	ZP
17XN2S	**Master project 2 for study programme IS**	Z	6	0P+4C	L	ZP
18XN2S	**Master project 2 for study programme IS**	Z	6	0P+4C	L	ZP
20XN2S	**Master project 2 for study programme IS** *Martin Leso, Jiří Růžička*	Z	6	0P+4C	L	ZP
21XN2S	**Master project 2 for study programme IS**	Z	6	0P+4C	L	ZP
22XN2S	**Master project 2 for study programme IS**	Z	6	0P+4C	L	ZP
23XN2S	**Master project 2 for study programme IS**	Z	6	0P+4C	L	ZP
11XN3S	**Master project 3 for study programme IS**	Z	6	0P+4C	Z	ZP
12XN3S	**Master project 3 for study programme IS**	Z	6	0P+4C	Z	ZP
14XN3S	**Master project 3 for study programme IS** *Zdeněk Lokaj, Tomáš Zelinka, Vít Fábera, Martin Šrotýř*	Z	6	0P+4C	Z	ZP
15XN3S	**Master project 3 for study programme IS**	Z	6	0P+4C	Z	ZP
16XN3S	**Master project 3 for study programme IS** *Petr Bouchner, Josef Mík, Dmitry Rozhdestvenskiy*	Z	6	0P+4C	Z	ZP
17XN3S	**Master project 3 for study programme IS**	Z	6	0P+4C	Z	ZP
18XN3S	**Master project 3 for study programme IS**	Z	6	0P+4C	Z	ZP
20XN3S	**Master project 3 for study programme IS** *Martin Leso, Milan Sliacky, Jiří Růžička*	Z	6	0P+4C	Z	ZP
21XN3S	**Master project 3 for study programme IS**	Z	6	0P+4C	Z	ZP
22XN3S	**Master project 3 for study programme IS**	Z	6	0P+4C	Z	ZP
23XN3S	**Master project 3 for study programme IS**	Z	6	0P+4C	Z	ZP
11XN4S	**Master project 4 for study programme IS**	Z	10	0P+8C	L	ZP
12XN4S	**Master project 4 for study programme IS**	Z	10	0P+8C	L	ZP
14XN4S	**Master project 4 for study programme IS** *Zdeněk Lokaj, Tomáš Zelinka, Vít Fábera, Martin Šrotýř, Jan Zelenka*	Z	10	0P+8C	L	ZP
15XN4S	**Master project 4 for study programme IS**	Z	10	0P+8C	L	ZP
16XN4S	**Master project 4 for study programme IS** *Petr Bouchner, Stanislav Novotný, Josef Mík*	Z	10	0P+8C	L	ZP
17XN4S	**Master project 4 for study programme IS**	Z	10	0P+8C	L	ZP
18XN4S	**Master project 4 for study programme IS** *Nela Krčmářová*	Z	10	0P+8C	L	ZP
20XN4S	**Master project 4 for study programme IS** *Milan Sliacky, Jiří Růžička*	Z	10	0P+8C	L	ZP
21XN4S	**Master project 4 for study programme IS**	Z	10	0P+8C	L	ZP
22XN4S	**Master project 4 for study programme IS**	Z	10	0P+8C	L	ZP
23XN4S	**Master project 4 for study programme IS**	Z	10	0P+8C	L	ZP

Characteristics of the courses of this group of Study Plan: Code=X2-NP-IS-CS-20/21 Name=Research Groups Master Full-Time IS (CS) from 2020/21

11XN1S	Master project 1 for study programme IS	Z	5
12XN1S	Master project 1 for study programme IS	Z	5
14XN1S	Master project 1 for study programme IS	Z	5
15XN1S	Master project 1 for study programme IS	Z	5
16XN1S	Master project 1 for study programme IS	Z	5
17XN1S	Master project 1 for study programme IS	Z	5
18XN1S	Master project 1 for study programme IS	Z	5
20XN1S	Master project 1 for study programme IS	Z	5
21XN1S	Master project 1 for study programme IS	Z	5
22XN1S	Master project 1 for study programme IS	Z	5
23XN1S	Master project 1 for study programme IS	Z	5
11XN2S	Master project 2 for study programme IS	Z	6

12XN2S	Master project 2 for study programme IS	Z	6
14XN2S	Master project 2 for study programme IS	Z	6
15XN2S	Master project 2 for study programme IS	Z	6
16XN2S	Master project 2 for study programme IS	Z	6
17XN2S	Master project 2 for study programme IS	Z	6
18XN2S	Master project 2 for study programme IS	Z	6
20XN2S	Master project 2 for study programme IS	Z	6
21XN2S	Master project 2 for study programme IS	Z	6
22XN2S	Master project 2 for study programme IS	Z	6
23XN2S	Master project 2 for study programme IS	Z	6
11XN3S	Master project 3 for study programme IS	Z	6
12XN3S	Master project 3 for study programme IS	Z	6
14XN3S	Master project 3 for study programme IS	Z	6
15XN3S	Master project 3 for study programme IS	Z	6
16XN3S	Master project 3 for study programme IS	Z	6
17XN3S	Master project 3 for study programme IS	Z	6
18XN3S	Master project 3 for study programme IS	Z	6
20XN3S	Master project 3 for study programme IS	Z	6
21XN3S	Master project 3 for study programme IS	Z	6
22XN3S	Master project 3 for study programme IS	Z	6
23XN3S	Master project 3 for study programme IS	Z	6
11XN4S	Master project 4 for study programme IS	Z	10
12XN4S	Master project 4 for study programme IS	Z	10
14XN4S	Master project 4 for study programme IS	Z	10
15XN4S	Master project 4 for study programme IS	Z	10
16XN4S	Master project 4 for study programme IS	Z	10
17XN4S	Master project 4 for study programme IS	Z	10
18XN4S	Master project 4 for study programme IS	Z	10
20XN4S	Master project 4 for study programme IS	Z	10
21XN4S	Master project 4 for study programme IS	Z	10
22XN4S	Master project 4 for study programme IS	Z	10
23XN4S	Master project 4 for study programme IS	Z	10

Name of the block: Elective courses
Minimal number of credits of the block: 0
The role of the block: V

Code of the group: VP-NP-IS-CS
Name of the group: Master Full-Time IS (CS) voluntary
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**
15JIA1	**Foreign Language - English 1** *Markéta Musilová, Dana Boušová, Jitka Heřmanová, Marie Michlová, Lenka Monková, Peter Morpuss, Eva Rezlerová*	Z	0	0P+2C	Z	v
15JIF1	**Foreign Language - French 1** *Irena Veselková*	Z	0	0P+2C	Z	v
15JIN1	**Foreign Language - German 1** *Eva Rezlerová, Martina Navrátilová, Jana Štikarová*	Z	0	0P+2C	Z	v
15JIR1	**Foreign Language - Russian 1** *Marie Michlová*	Z	0	0P+2C	Z	v
15JIS1	**Foreign Language - Spanish 1** *Nina Hricsina Puškinová*	Z	0	0P+2C	Z	v
15JIA2	**Foreign Language - English 2** *Eva Rezlerová*	Z	0	0P+2C	L	v
15JIF2	**Foreign Language - French 2** *Irena Veselková*	Z	0	0P+2C	L	v
15JIN2	**Foreign Language - German 2** *Eva Rezlerová, Martina Navrátilová, Jana Štikarová*	Z	0	0P+2C	L	v
15JIR2	**Foreign Language - Russian 2** *Marie Michlová*	Z	0	0P+2C	L	v

15JIS2	**Foreign Language - Spanish 2** *Nina Hricsina Puškinová*	Z	0	0P+2C	L	v
15JIA3	**Foreign Language - English 3** *Markéta Musilová, Dana Boušová, Jitka Heřmanová, Marie Michlová, Lenka Monková, Peter Morpuss, Eva Rezlerová, Markéta Vojanová*	Z	0	0P+2C	Z	v
15JIF3	**Foreign Language - French 3** *Irena Veselková*	Z	0	0P+2C	Z	v
15JIN3	**Foreign Language - German 3** *Eva Rezlerová, Martina Navrátilová, Jana Štikarová*	Z	0	0P+2C	Z	v
15JIR3	**Foreign Language - Russian 3** *Marie Michlová*	Z	0	0P+2C	Z	v
15JIS3	**Foreign Language - Spanish 3** *Nina Hricsina Puškinová*	Z	0	0P+2C	Z	v
15JIA4	**Foreign Language - English 4** *Eva Rezlerová*	Z	0	0P+2C	L	v
15JIF4	**Foreign Language - French 4** *Irena Veselková*	Z	0	0P+2C	L	v
15JIN4	**Foreign Language - German 4** *Eva Rezlerová, Martina Navrátilová, Jana Štikarová*	Z	0	0P+2C	L	v
15JIR4	**Foreign Language - Russian 4** *Marie Michlová*	Z	0	0P+2C	L	v
15JIS4	**Foreign Language - Spanish 4** *Nina Hricsina Puškinová*	Z	0	0P+2C	L	v

Characteristics of the courses of this group of Study Plan: Code=VP-NP-IS-CS Name=Master Full-Time IS (CS) voluntary

15JIA1	Foreign Language - English 1	Z	0
Work on specialised texts and technical terminology. Lexical-grammatical structures of higher command. Formal language. Improvement of communication skills. Active use of foreign language in presentations within students´ specialization field both in verbal and written forms. Language laboratory environment used alternatively as a tool for active learning (Programmes - English Connections, English Library, the Internet).			
15JIF1	Foreign Language - French 1	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIN1	Foreign Language - German 1	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIR1	Foreign Language - Russian 1	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIS1	Foreign Language - Spanish 1	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIA2	Foreign Language - English 2	Z	0
Work on specialised texts and technical terminology. Lexical-grammatical structures of higher command. Formal language. Improvement of communication skills. Active use of foreign language in presentations within students´ specialization field both in verbal and written form. Language laboratory environment used alternatively as a tool for active learning (Programmes - English Connections, English Library, the Internet).			
15JIF2	Foreign Language - French 2	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIN2	Foreign Language - German 2	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIR2	Foreign Language - Russian 2	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIS2	Foreign Language - Spanish 2	Z	0
Basic structures of Spanish language, communication in everyday life, study, work, leisere time activities, introducing myself, phonetics of Spanish language, writing skills.			
15JIA3	Foreign Language - English 3	Z	0
Presentation skills - expert technical discourse and style. Analysis of expert texts and their production. Preparation for overseas work engagement. Optional courses for certificates FCE, CAE.			
15JIF3	Foreign Language - French 3	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIN3	Foreign Language - German 3	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIR3	Foreign Language - Russian 3	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIS3	Foreign Language - Spanish 3	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIA4	Foreign Language - English 4	Z	0
Presentation Skills - expert technical discourse and style. Analysis of expert texts and their production. Preparation for overseas work engagement. Optional courses for certificates FCE, CAE.			

15JIF4	Foreign Language - French 4	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIN4	Foreign Language - German 4	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIR4	Foreign Language - Russian 4	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIS4	Foreign Language - Spanish 4	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			

List of courses of this pass:

Code	Name of the course	Completion	Credits
11MAI	ITS Mathematical Tools	Z,ZK	4
Series, Fourier Series. Discrete Fourier Transform. Segmentation of signals, windows, localization. Short-term Fourier Transform. From Fourier Analysis to PDE. Fundamentals of Numerical Mathematics. Numerical solutions to ODEs and PDEs. Continuous traffic flow models described by PDE. Car-following models as ODEs.			
11XN1S	Master project 1 for study programme IS	Z	5
11XN2S	Master project 2 for study programme IS	Z	6
11XN3S	Master project 3 for study programme IS	Z	6
11XN4S	Master project 4 for study programme IS	Z	10
12TDP	Traffic Flow Theory	Z,ZK	3
Mobility and associated human problems. Basic traffic parameters and their measurement. Estimation of quality of services. Theoretical fundamentals and applications of mathematical models. Macroscopic, statistical and microscopic models. Theory of shock waves, queuing theory and special theory of traffic phenomena. Relation between traffic models and traffic flow management.			
12XN1S	Master project 1 for study programme IS	Z	5
12XN2S	Master project 2 for study programme IS	Z	6
12XN3S	Master project 3 for study programme IS	Z	6
12XN4S	Master project 4 for study programme IS	Z	10
14CITS	C-ITS Systems	Z,ZK	6
Detailed description of C-ITS systems architecture, description of use-cases - urban and rural applications, principles of C-ITS funcionality with focus on data exchange (CAM, DENM, IVI) and C-ITS security architecture. Status quo and modern trends of wireless telecommunication solutions ITS-G5 and LTE-V and description of its properties and specifics. Course will also cover signal processing.			
14MIM	Microsimulation Models	KZ	3
Basic knowledge of traffic modeling and simulation will be broaded by the application of traffic control algorithms to traffic microsimulation models used in ITS. These include, for example, the proposal of algorithms for actuated signal control, pedestrian preference, dynamic network routing, road line traffic control, crossing security equipment, and PT preference. Algorithms will be designed, applied, and tested by students themselves.			
14PAM	Programming and modelling	Z,ZK	4
Object oriented programming, dynamic memory allocation, inheritage, generic programming, STL, abstract data types, programming techniques, recursion, complexity, Lindenmeyer's grammars, paralism in nature and in real systems, paralel computer systems, paralel programming, discrete simulation, models of processes, model types As-Is a To-Be, acquisition of analytical sources for modelling, BPMN language, SW Bizagi, model creation and life cycle.			
14PD	Data processing	Z,ZK	6
Students will learn about tools for data processing and analysis, using practical examples to try out the most common options used in data processing, including advanced options for presenting the results of analyses. In advanced methods, students will also perform specific analysis using Bayesian networks. Students will then independently perform data analysis on data from existing open systems.			
14PPRP	Computer Aided Project Management	KZ	2
What is the project? The basic terms a concepts of project management. Life cycle of the project and its phased approach. Analysis and specification of the assignment, activity definition, stages, objectives and measurability. Risk events and risk planning. Project change management during implementation. Preparation of the project outline (activities, restrictions, assignments, calendars etc.) Project planning and optimization - time, resources.			
14XN1S	Master project 1 for study programme IS	Z	5
14XN2S	Master project 2 for study programme IS	Z	6
14XN3S	Master project 3 for study programme IS	Z	6
14XN4S	Master project 4 for study programme IS	Z	10
15JIA1	Foreign Language - English 1	Z	0
Work on specialised texts and technical terminology. Lexical-grammatical structures of higher command. Formal language. Improvement of communication skills. Active use of foreign language in presentations within students´ specialization field both in verbal and written forms. Language laboratory environment used alternatively as a tool for active learning (Programmes - English Connections, English Library, the Internet).			
15JIA2	Foreign Language - English 2	Z	0
Work on specialised texts and technical terminology. Lexical-grammatical structures of higher command. Formal language. Improvement of communication skills. Active use of foreign language in presentations within students´ specialization field both in verbal and written form. Language laboratory environment used alternatively as a tool for active learning (Programmes - English Connections, English Library, the Internet).			

15JIA3	Foreign Language - English 3	Z	0
Presentation skills - expert technical discourse and style. Analysis of expert texts and their production. Preparation for overseas work engagement. Optional courses for certificates FCE, CAE.			
15JIA4	Foreign Language - English 4	Z	0
Presentation Skills - expert technical discourse and style. Analysis of expert texts and their production. Preparation for overseas work engagement. Optional courses for certificates FCE, CAE.			
15JIF1	Foreign Language - French 1	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIF2	Foreign Language - French 2	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIF3	Foreign Language - French 3	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIF4	Foreign Language - French 4	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIN1	Foreign Language - German 1	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIN2	Foreign Language - German 2	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIN3	Foreign Language - German 3	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIN4	Foreign Language - German 4	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIR1	Foreign Language - Russian 1	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIR2	Foreign Language - Russian 2	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIR3	Foreign Language - Russian 3	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIR4	Foreign Language - Russian 4	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIS1	Foreign Language - Spanish 1	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIS2	Foreign Language - Spanish 2	Z	0
Basic structures of Spanish language, communication in everyday life, study, work, leisere time activities, introducing myself, phonetics of Spanish language, writing skills.			
15JIS3	Foreign Language - Spanish 3	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15JIS4	Foreign Language - Spanish 4	Z	0
Basic structures of foreign language, communication in everyday life, study, work, leiser time activities, introducing myself, phonetics of foreign language, writing skills, in advanced groups texts with professional topics.			
15XN1S	Master project 1 for study programme IS	Z	5
15XN2S	Master project 2 for study programme IS	Z	6
15XN3S	Master project 3 for study programme IS	Z	6
15XN4S	Master project 4 for study programme IS	Z	10
16DITS	Vehicles within ITS	Z,ZK	4
Design of the vehicle with focus on its use and function in frame of ITS. User requirement analyses. Economic aspects. Process of constructions in a concept phase, functional dependences and structure of the designed object. Creation of functional models. Energy management and storages for ground vehicles, energy transformations leading to kinetic one. Propulsion systems / traditional and alternative ones. Life-cycle analysis.			
16ESDP	Electronic systems in modern vehicles	Z,ZK	3
Advanced vehicle systems, electromobility, V2I and V2V, autonomous driving. Combustion engine control and electronic control units. Electric propulsion, its components, basic characteristics and control. Management of hybrid propulsion for attaining its optimal efficiency. Vehicle communication bus (CAN, LIN, FlexRay etc.). Safety, communication and comfort electronic vehicle systems. Practical exercises with real and simulated systems.			
16SHMI	Simulation and HMI	Z,ZK	3
Simulation for the systems in transportation and vehicle systems. User interface, HMI (human-machine interaction), virtual reality and computer graphics for ITS. Simulation theory with application of computing equipment. Creating computing models. Mechanic and dynamic systems and their mathematical models. Simulation of vehicle dynamics, on-land carriage in particular. Virtual reality systems.			
16XN1S	Master project 1 for study programme IS	Z	5

16XN2S	Master project 2 for study programme IS	Z	6
16XN3S	Master project 3 for study programme IS	Z	6
16XN4S	Master project 4 for study programme IS	Z	10
17XN1S	Master project 1 for study programme IS	Z	5
17XN2S	Master project 2 for study programme IS	Z	6
17XN3S	Master project 3 for study programme IS	Z	6
17XN4S	Master project 4 for study programme IS	Z	10
18XN1S	Master project 1 for study programme IS	Z	5
18XN2S	Master project 2 for study programme IS	Z	6
18XN3S	Master project 3 for study programme IS	Z	6
18XN4S	Master project 4 for study programme IS	Z	10
20BITS	Safety and reliability of ITS Systems	KZ	3
The basic concepts of safety and reliability in the job and application. Basic schema and types of diagnostic systems including reliability diagnostics of technical equipment and ITS. Investigation of acceptability and reliability prediction, traffic crity and sensitivity analysis. Neural Networks and other optimization algorithms and ETA, FMEA failure analysis. HMI in traffic including operator testing on simulator and in real-world situatiation			
20GINS	Geographical, information, localization and navigation systems	Z,ZK	6
The subject is specialized in problems of work with applications of geographic information systems with special attention to the specialization in the field of transport and telecommunication. It introduces students to geographic data management practices and tools, real world modeling, geographic data storage models, data entry and digitization methods, and a number of other GIS related technologies such as problem mapping, webmap, etc.			
20ITSR	ITS - R	Z,ZK	3
The introduction is devoted to description of the architecture and interface of the system with the ITS-R concept, the communication interface of the system, principles of ensuring functional and security features are defined. The principles of ERTMS / ETCS application level 3, UGTMS, CBTC are discussed in detail. Current and future communication technologies are described.			
20MZZ	Modern techniques of safety control of moving railway vehicles	Z,ZK	3
ERTMS / ETCS concepts, ETCS architecture and interface descriptions, ERTMS system level, infrastructure and mobile part of the system, linking to stationary security systems, operating and application modes of the system, infrastructure orientation, interface (DMI), integration of the ETCS mobile part into the driving vehicle, GSM-R functional specification, testing and legislation.			
20TBSS	Technology and Security of Sensor Networks	KZ	2
Basic concepts of safety and reliability in transport and its application. Basic scheme and types of diagnostic systems, including reliability diagnostics of technological equipment and ITS. Investigation of the area of acceptability and prediction of reliability, sensitivity in transport and sensitivity analysis. Neural networks and other optimization algorithms and fault analysis ETA, FMEA. HMI in transport, including operator testing on a simulator and in real situations.			
20TSJ	Telematic systems and their design	Z,ZK	6
Gradual detailed analysis of individual existing telematics systems in modes of transport, such as toll systems, vehicle weighing, fleet management, traffic management, etc.			
20XN1S	Master project 1 for study programme IS	Z	5
20XN2S	Master project 2 for study programme IS	Z	6
20XN3S	Master project 3 for study programme IS	Z	6
20XN4S	Master project 4 for study programme IS	Z	10
21XN1S	Master project 1 for study programme IS	Z	5
21XN2S	Master project 2 for study programme IS	Z	6
21XN3S	Master project 3 for study programme IS	Z	6
21XN4S	Master project 4 for study programme IS	Z	10
22XN1S	Master project 1 for study programme IS	Z	5
22XN2S	Master project 2 for study programme IS	Z	6
22XN3S	Master project 3 for study programme IS	Z	6
22XN4S	Master project 4 for study programme IS	Z	10
23XN1S	Master project 1 for study programme IS	Z	5
23XN2S	Master project 2 for study programme IS	Z	6
23XN3S	Master project 3 for study programme IS	Z	6
23XN4S	Master project 4 for study programme IS	Z	10

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