Study plan

Name of study plan: Master Full-Time IS (CS) from 2022/23

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: 120
Elective courses credits: 0
Sum of credits in the plan: 120
Note on the plan:

Name of the block: Compulsory courses
Minimal number of credits of the block: 93
The role of the block: Z

Code of the group: 1S-NP-IS-CS-20/21
Name of the group: 1st Sem. Master Full-Time IS (CS) from 2020/21
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
23TBSS	**Technology and Security of Sensor Networks**	KZ	2	2P+0C	Z	z

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

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.			
23TBSS	Technology and Security of Sensor Networks	KZ	2
The course focuses on the safety of data collection in new areas of sensor networks. Principles of sensor networks, sensors of electrical and non-electric quantities, interfaces for sensor connection, communication technology for sensor networks, SigFox, LoRa, NB-IoT, IoT technology and SmartCity. Trends in IoT and Smart City			

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, Tomáš Zelinka, Miroslav Vaniš **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** *Vladimír Faltus, Tomáš Tichý*	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.			

Code of the group: 3S-NP-IS-CS-21/22
Name of the group: 3rd Sem. Master Full-Time IS (CS) from 2021/22
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 4 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
11MMAD	**Mathematical Methods for Data Analysis** *Pavla Pecherková, Tetiana Reznychenko, Evženie Uglickich, Ivan Nagy* ***Pavla Pecherková*** *Ivan Nagy (Gar.)*	Z,ZK	6	3P+3C	Z	z
20AIMI	**Application of ITS in Urban Engineering** *Tomáš Tichý, Josef Kocourek, Dagmar Kočárková, Jiří Růžička, Josef Filip* ***Tomáš Tichý***	Z,ZK	6	3P+3C	Z	z
20SYIN	**System Engineering** *Zuzana Bělinová, Veronika Vlčková* ***Zuzana Bělinová***	Z,ZK	6	4P+2C	Z	z
20HEI	**Evaluation and Economics of ITS** *František Kopecký* ***František Kopecký***	KZ	3	2P+1C	Z	z

Characteristics of the courses of this group of Study Plan: Code=3S-NP-IS-CS-21/22 Name=3rd Sem. Master Full-Time IS (CS) from 2021/22

11MMAD	Mathematical Methods for Data Analysis	Z,ZK	6
Stocastic modelling, estimation, prediction, filtration, control, methods of data analysis: k-means, DBSCAN, naive Bayes, decision trees, support vector machine.			

20AIMI	Application of ITS in Urban Engineering	Z,ZK	6
The course focuses mainly on the issue of the installation of engineering networks in the area, coordination of engineering activities in the area, organization of the public space, concept of public space solutions, design of systems for traffic and transport telematics management, coordination of transport modes - automobil, pedestrian, MHD, cyclo, modes etc. New approaches to the development of Smart and green approaches Promoting into Public.			
20SYIN	System Engineering	Z,ZK	6
Enhanced system definition in engineering tasks, specification of selected system types against related tools of system analysis and design, refinement of selected types of system engineering tasks, definition of system strategy, connection to science-based methodological basics of transport, strategic thinking processes, strategic management system, context of sustainable development.			
20HEI	Evaluation and Economics of ITS	KZ	3
Introduction of subject is devoted to the basics of system approach to development of ITS architecture and fundamentals in the field of economic attributes connected with development of ITS. Subsequently, the basic principles of system and application creation in the technical field are discussed, defining the penetration of the technical solution into the economy. The subject is terminated by a detailed breakdown of case studies.			

Code of the group: 3S-NP-IS-CS-V-21/22
Name of the group: 3rd Sem. Master Full-Time IS (CS) Alternative from 2021/22
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
16KSD	**Quality and reliability in area of transportation means and systems** *Jan Leistner, Filip Kotas, David Lehet, Jaroslav Machan*	Z,ZK	3	2P+1C	Z	z
20PRZP	**Computer aided railway traffic control** *Dušan Kamenický* ***Dušan Kamenický***	Z,ZK	3	2P+1C	Z	z
20TVHD	**Telematics in Public Transport** *Milan Sliacky* ***Milan Sliacky***	Z,ZK	3	2P+1C	Z	z

Characteristics of the courses of this group of Study Plan: Code=3S-NP-IS-CS-V-21/22 Name=3rd Sem. Master Full-Time IS (CS) Alternative from 2021/22

16KSD	Quality and reliability in area of transportation means and systems	Z,ZK	3
Quality methods used for design, manufacturing and operation. Methods QFD, DFM, DFA, DFS. Longtime testing. FMEA method. Operation reliability. Methods for process optimizing, process design and quality improvement (Six Sigma etc.). Certification and accreditation, quality management, tools and methods for quality stabilization and improvement. Students will work on real problems in the QFD laboratory.			
20PRZP	Computer aided railway traffic control	Z,ZK	3
Introduction is devoted to clarifying the reasons and basic principles of automation of the management of railway transport. It explains the structure of railway traffic management, including the main principles applied in the management of railway traffic. The main part is devoted to detailed description of the individual components of the system, which must be included in the systems for automation of railway traffic control using computer technologies.			
20TVHD	Telematics in Public Transport	Z,ZK	3
Ticketing and information systems; foreinght experiences; vehicle technology; dispatching systems; Information Systems; data structures; clearing; Public Transport preferences; vehicle position monitoring; legislative framework; standardization, certification and interoperability.			

Code of the group: XD-NP-IS-CS-21/22
Name of the group: Thesis Master Full-Time IS (CS) from 2021/22
Requirement credits in the group: In this group you have to gain 16 credits
Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 16
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
11XNDS	**Master Thesis for study programme IS**	Z	16	0P+16C	L	z
12XNDS	**Master Thesis for study programme IS**	Z	16	0P+16C	L	z
14XNDS	**Master Thesis for study programme IS** *Zdeněk Lokaj, Tomáš Zelinka, Vít Fábera, Martin Šrotýř, Jan Krčál, Jana Kaliková, Jan Zelenka*	Z	16	0P+16C	L	z
15XNDS	**Master Thesis for study programme IS**	Z	16	0P+16C	L	z
16XNDS	**Master Thesis for study programme IS** *Petr Bouchner, Stanislav Novotný, Tereza Kunclová, Josef Mík*	Z	16	0P+16C	L	z
17XNDS	**Master Thesis for study programme IS**	Z	16	0P+16C	L	z
18XNDS	**Master Thesis for study programme IS**	Z	16	0P+16C	L	z

20XNDS	**Master Thesis for study programme IS** *Martin Leso, Milan Sliacky*	Z	16	0P+16C	L	z
21XNDS	**Master Thesis for study programme IS**	Z	16	0P+16C	L	z
22XNDS	**Master Thesis for study programme IS**	Z	16	0P+16C	L	z
23XNDS	**Master Thesis for study programme IS**	Z	16	0P+16C	L	z

Characteristics of the courses of this group of Study Plan: Code=XD-NP-IS-CS-21/22 Name=Thesis Master Full-Time IS (CS) from 2021/22

11XNDS	Master Thesis for study programme IS	Z	16
12XNDS	Master Thesis for study programme IS	Z	16
14XNDS	Master Thesis for study programme IS	Z	16
15XNDS	Master Thesis for study programme IS	Z	16
16XNDS	Master Thesis for study programme IS	Z	16
17XNDS	Master Thesis for study programme IS	Z	16
18XNDS	Master Thesis for study programme IS	Z	16
20XNDS	Master Thesis for study programme IS	Z	16
21XNDS	Master Thesis for study programme IS	Z	16
22XNDS	Master Thesis for study programme IS	Z	16
23XNDS	Master Thesis for study programme IS	Z	16

Code of the group: XP-NP-IS-CS-21/22
Name of the group: Praxis Master Full-Time IS (CS) from 2021/22
Requirement credits in the group: In this group you have to gain 4 credits
Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 4
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**
11XPXS	**Training course for study programme IS**	Z	4	0P+4C	L	z
12XPXS	**Training course for study programme IS**	Z	4	0P+4C	L	z
14XPXS	**Training course for study programme IS** *Vít Fábera, Jana Kaliková*	Z	4	0P+4C	L	z
15XPXS	**Training course for study programme IS**	Z	4	0P+4C	L	z
16XPXS	**Training course for study programme IS** *Josef Mík*	Z	4	0P+4C	L	z
17XPXS	**Training course for study programme IS**	Z	4	0P+4C	L	z
18XPXS	**Training course for study programme IS**	Z	4	0P+4C	L	z
20XPXS	**Training course for study programme IS** *Jiří Růžička*	Z	4	0P+4C	L	z
21XPXS	**Training course for study programme IS**	Z	4	0P+4C	L	z
22XPXS	**Training course for study programme IS**	Z	4	0P+4C	L	z
23XPXS	**Training course for study programme IS**	Z	4	0P+4C	L	z

Characteristics of the courses of this group of Study Plan: Code=XP-NP-IS-CS-21/22 Name=Praxis Master Full-Time IS (CS) from 2021/22

11XPXS	Training course for study programme IS	Z	4
12XPXS	Training course for study programme IS	Z	4
14XPXS	Training course for study programme IS	Z	4
15XPXS	Training course for study programme IS	Z	4
16XPXS	Training course for study programme IS	Z	4
17XPXS	Training course for study programme IS	Z	4
18XPXS	Training course for study programme IS	Z	4
20XPXS	Training course for study programme IS	Z	4
21XPXS	Training course for study programme IS	Z	4
22XPXS	Training course for study programme IS	Z	4
23XPXS	Training course for study programme IS	Z	4

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** *Milan Sliacky, Josef Mík*	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, Martin Leso, Jiří Růžička, Jiří Brož*	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, Jiří Růžička, Milan Sliacky*	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** *Martin Leso, Jiří Růžička, Milan Sliacky*	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.			
11MMAD	Mathematical Methods for Data Analysis	Z,ZK	6
Stocastic modelling, estimation, prediction, filtration, control, methods of data analysis: k-means, DBSCAN, naive Bayes, decision trees, support vector machine.			
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
11XNDS	Master Thesis for study programme IS	Z	16
11XPXS	Training course for study programme IS	Z	4
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
12XNDS	Master Thesis for study programme IS	Z	16
12XPXS	Training course for study programme IS	Z	4
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
14XNDS	Master Thesis for study programme IS	Z	16
14XPXS	Training course for study programme IS	Z	4
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
15XNDS	Master Thesis for study programme IS	Z	16
15XPXS	Training course for study programme IS	Z	4
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.			
16KSD	Quality and reliability in area of transportation means and systems	Z,ZK	3
Quality methods used for design, manufacturing and operation. Methods QFD, DFM, DFA, DFS. Longtime testing. FMEA method. Operation reliability. Methods for process optimizing, process design and quality improvement (Six Sigma etc.). Certification and accreditation, quality management, tools and methods for quality stabilization and improvement. Students will work on real problems in the QFD laboratory.			
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
16XNDS	Master Thesis for study programme IS	Z	16
16XPXS	Training course for study programme IS	Z	4
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
17XNDS	Master Thesis for study programme IS	Z	16
17XPXS	Training course for study programme IS	Z	4
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
18XNDS	Master Thesis for study programme IS	Z	16
18XPXS	Training course for study programme IS	Z	4
20AIMI	Application of ITS in Urban Engineering	Z,ZK	6
The course focuses mainly on the issue of the installation of engineering networks in the area, coordination of engineering activities in the area, organization of the public space, concept of public space solutions, design of systems for traffic and transport telematics management, coordination of transport modes - automobil, pedestrian, MHD, cyclo, modes etc. New approaches to the development of Smart and green approaches Promoting into Public.			
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.			

20HEI	Evaluation and Economics of ITS	KZ	3
Introduction of subject is devoted to the basics of system approach to development of ITS architecture and fundamentals in the field of economic attributes connected with development of ITS. Subsequently, the basic principles of system and application creation in the technical field are discussed, defining the penetration of the technical solution into the economy. The subject is terminated by a detailed breakdown of case studies.			
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.			
20PRZP	Computer aided railway traffic control	Z,ZK	3
Introduction is devoted to clarifying the reasons and basic principles of automation of the management of railway transport. It explains the structure of railway traffic management, including the main principles applied in the management of railway traffic. The main part is devoted to detailed description of the individual components of the system, which must be included in the systems for automation of railway traffic control using computer technologies.			
20SYIN	System Engineering	Z,ZK	6
Enhanced system definition in engineering tasks, specification of selected system types against related tools of system analysis and design, refinement of selected types of system engineering tasks, definition of system strategy, connection to science-based methodological basics of transport, strategic thinking processes, strategic management system, context of sustainable development.			
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.			
20TVHD	Telematics in Public Transport	Z,ZK	3
Ticketing and information systems; foreinght experiences; vehicle technology; dispatching systems; Information Systems; data structures; clearing; Public Transport preferences; vehicle position monitoring; legislative framework; standardization, certification and interoperability.			
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
20XNDS	Master Thesis for study programme IS	Z	16
20XPXS	Training course for study programme IS	Z	4
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
21XNDS	Master Thesis for study programme IS	Z	16
21XPXS	Training course for study programme IS	Z	4
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
22XNDS	Master Thesis for study programme IS	Z	16
22XPXS	Training course for study programme IS	Z	4
23TBSS	Technology and Security of Sensor Networks	KZ	2
The course focuses on the safety of data collection in new areas of sensor networks. Principles of sensor networks, sensors of electrical and non-electric quantities, interfaces for sensor connection, communication technology for sensor networks, SigFox, LoRa, NB-IoT, IoT technology and SmartCity. Trends in IoT and Smart City			
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
23XNDS	Master Thesis for study programme IS	Z	16
23XPXS	Training course for study programme IS	Z	4

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