

Study plan

Name of study plan: navaz. mag. PRE program SC 20/21 (pro studenty, kteří absolvovali v které předchozí 1. ročníku na UTEP)

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch:

Program of study: Smart Cities

Type of study: Follow-up master full-time

Required credits: 60

Elective courses credits: 0

Sum of credits in the plan: 60

Note on the plan:

Name of the block: Semestrální projekt

Minimal number of credits of the block: 8

The role of the block: ZP

Code of the group: XN SC 1-2 20/21

Name of the group: Projekty navaz. prez. 1.-2. sem na FD programu SC

Requirement credits in the group: In this group you have to gain 8 credits

Requirement courses in the group: In this group you have to complete 2 courses

Credits in the group: 8

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
11XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
12XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
14XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
15XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
16XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
17XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
18XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
20XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
21XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
22XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
23XN1C	Thesis 1	Z	4	0P+4C	Z	ZP
11XN2C	Thesis 2	Z	4	0P+4C	L	ZP
12XN2C	Thesis 2	Z	4	0P+4C	L	ZP
14XN2C	Thesis 2	Z	4	0P+4C	L	ZP
15XN2C	Thesis 2	Z	4	0P+4C	L	ZP
16XN2C	Thesis 2	Z	4	0P+4C	L	ZP
17XN2C	Thesis 2	Z	4	0P+4C	L	ZP
18XN2C	Thesis 2	Z	4	0P+4C	L	ZP
20XN2C	Thesis 2	Z	4	0P+4C	L	ZP
21XN2C	Thesis 2	Z	4	0P+4C	L	ZP
22XN2C	Thesis 2	Z	4	0P+4C	L	ZP
23XN2C	Thesis 2	Z	4	0P+4C	L	ZP

Characteristics of the courses of this group of Study Plan: Code=XN SC 1-2 20/21 Name=Projekty navaz. prez. 1.-2. sem na FD programu SC

11XN1C	Thesis 1	Z	4
12XN1C	Thesis 1	Z	4
14XN1C	Thesis 1	Z	4
15XN1C	Thesis 1	Z	4
16XN1C	Thesis 1	Z	4
17XN1C	Thesis 1	Z	4
18XN1C	Thesis 1	Z	4
20XN1C	Thesis 1	Z	4
21XN1C	Thesis 1	Z	4
22XN1C	Thesis 1	Z	4
23XN1C	Thesis 1	Z	4
11XN2C	Thesis 2	Z	4
12XN2C	Thesis 2	Z	4
14XN2C	Thesis 2	Z	4
15XN2C	Thesis 2	Z	4
16XN2C	Thesis 2	Z	4
17XN2C	Thesis 2	Z	4
18XN2C	Thesis 2	Z	4
20XN2C	Thesis 2	Z	4
21XN2C	Thesis 2	Z	4
22XN2C	Thesis 2	Z	4
23XN2C	Thesis 2	Z	4

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 50

The role of the block: P

Code of the group: 1.S.NPSC FD 20/21

Name of the group: 1.s.nav.prez 20/21 - program SC pro studenty UTEP (p edm ty FD)

Requirement credits in the group: In this group you have to gain 12 credits

Requirement courses in the group: In this group you have to complete 2 courses

Credits in the group: 12

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
20AIMI	Application of ITS in Urban Engineering <i>Ji í R ži ka, Josef Filip, Tomáš Tichý</i>	Z,ZK	6	3P+3C	Z	P
20GINS	Geographical, information, localization and navigation systems <i>Pavel Hruběš, Petr Bureš, Zuzana Purkrábková, František Kekula</i>	Z,ZK	6	3P+3C	Z	P

Characteristics of the courses of this group of Study Plan: Code=1.S.NPSC FD 20/21 Name=1.s.nav.prez 20/21 - program SC pro studenty UTEP (p edm ty FD)

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.			
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.			

Code of the group: 1.S.NPSC UTEP 20/21

Name of the group: 1.s.nav.prez 20/21 SC:p edm ty z SC+IS(EN) pro studenty, kte í 17SCF nebo 17TSC absolvují na UTEP

Requirement credits in the group: In this group you have to gain at least 12 credits

Requirement courses in the group: In this group you have to complete at least 2 courses

Credits in the group: 12

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
17SCF	Smart Cities Fundamentals	Z,ZK	6	3P+2C	Z	P
17TSC	Technologies for Smart Cities	Z,ZK	6	3P+2C	Z	P
11MAI	ITS Mathematical Tools <i>Jan P ikryl Jan P ikryl Jan P ikryl (Gar.)</i>	Z,ZK	4	2P+2C	Z	P
12TDP	Traffic Flow Theory <i>Vladimír Faltus</i>	Z,ZK	3	2P+1C	Z	P
16ESDP	Electronic systems in modern vehicles <i>Petr Bouchner, Dmitrij Rožd stvenský</i>	Z,ZK	3	2P+1C	Z	P
20MZZ	Modern techniques of safety control of moving railway vehicles <i>Martin Leso</i>	Z,ZK	3	2P+1C	Z	P
16DITS	Vehicles within ITS <i>David Lehet, Jaroslav Machan</i>	Z,ZK	4	2P+2C	Z	P
20TSJ	Telematic systems and their design <i>Pavel Hruběš, Martin Langr</i>	Z,ZK	6	3P+2C	Z	P
23TBSS	Technology and Security of Sensor Networks <i>Václav Jirovský Václav Jirovský Václav Jirovský (Gar.)</i>	KZ	2	2P+0C	Z	P
11MMAD	Mathematical Methods for Data Analysis <i>Pavla Pecherková, Tetiana Reznichenko, Evžen Uglickich, Ivan Nagy Pavla Pecherková Ivan Nagy (Gar.)</i>	Z,ZK	6	3P+3C	Z	P
16KSD	Quality and reliability in area of transportation means and systems <i>David Lehet, Jaroslav Machan</i>	Z,ZK	3	2P+1C	Z	P
20PRZP	Computer aided railway traffic control <i>Dušan Kamenický</i>	Z,ZK	3	2P+1C	Z	P
20TVHD	Telematics in Public Transport <i>Milan Sliacky</i>	Z,ZK	3	2P+1C	Z	P
20SYIN	System Engineering <i>Zuzana B linová, Veronika Vl ková</i>	Z,ZK	6	4P+2C	Z	P
20HEI	Evaluation and Economics of ITS <i>František Kopecký</i>	KZ	3	2P+1C	Z	P

Characteristics of the courses of this group of Study Plan: Code=1.S.NPSC UTEP 20/21 Name=1.s.nav.prez 20/21 SC:p edm ty z SC+IS(EN) pro studenty, kte í 17SCF nebo 17TSC absolvují na UTEP

17SCF	Smart Cities Fundamentals	Z,ZK	6
The main smart city components will be described (intelligent transport systems, smart grids, smart buildings, smart lighting, e-governance, etc.) together with their integration methods by using existing international standards to achieve the synergies among different sectors. The quality of life for different city residents is understood as the main criterial function.			
17TSC	Technologies for Smart Cities	Z,ZK	6
Each presented technology will be described through performance parameters like safety, reliability, integrity, continuity, etc. New business models of technologies' implementation and operation will be introduced to provide advanced deployment decision-making. Legal aspects of technologies' assessment (e.g. GDPR) will be presented for selected application areas.			
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.			
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.			
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.			
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			
11MMAD	Mathematical Methods for Data Analysis	Z,ZK	6
Stochastic modelling, estimation, prediction, filtration, control, methods of data analysis: k-means, DBSCAN, naive Bayes, decision trees, support vector machine.			

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.			
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: 2.S.NPSC FD 20/21

Name of the group: 2.s.nav.prez 20/21 - program SC pro studenty UTEP (p edm ty FD)

Requirement credits in the group: In this group you have to gain 14 credits

Requirement courses in the group: In this group you have to complete 4 courses

Credits in the group: 14

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
14CISC	Cyber Infrastructure for Smart Cities	Z,ZK	3	2P+1C	L	P
17SU	Smart Urbanism	Z,ZK	6	2P+3C	L	P
14FCL	Future Cities Laboratory	KZ	3	0P+3C	L	P
17PJMG	Project Management	KZ	2	2P+0C	L	P

Characteristics of the courses of this group of Study Plan: Code=2.S.NPSC FD 20/21 Name=2.s.nav.prez 20/21 - program SC pro studenty UTEP (p edm ty FD)

14CISC	Cyber Infrastructure for Smart Cities	Z,ZK	3
Status quo and trends in telecommunications systems applied in cyber infrastructure, technical, economical and legal aspects of telecommunications networks design and services provisioning, identification and quantification of hiererchical telecommunications networks and services performance, telecommunication services dedicated for transport and specifically Smart Cities solutions.			
17SU	Smart Urbanism	Z,ZK	6
Urban metabolism and ecology, urban morphology and land use, urban society: demography, mobility, social transtition, urban space and places, urban flows, urban modeling, impact of technology innovations on urban transition.			
14FCL	Future Cities Laboratory	KZ	3
Future cities system architecture (with focus on C-ITS) and reference projects, functional and technology solutions description and principles, wireless telco solutions dedicated for C-ITS systems (ITS-G5, LTE-V, etc.), security architecture, data security and personal data protection, testing of the systems and functional parameters assessment, technical properties evaluaition, methods of data collection and processing.			
17PJMG	Project Management	KZ	2
Basic terms of the project management, project management standards, organizational structures and processess in the project management, life-cycle of the project, risk analysis, projects in transport and transport infrastructure and their specifics, feasibility study and CBA, project evaluation, PPP projects.			

Code of the group: 2.S.NPSC UTEP 20/21

Name of the group: 2.s.nav.prez 20/21 SC: p edm ty z SC+IS(EN) pro ty, kte í 11SMCD nebo 17SCAR absolvují na UTEP

Requirement credits in the group: In this group you have to gain at least 9 credits

Requirement courses in the group: In this group you have to complete at least 2 courses

Credits in the group: 9

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
11SMCD	Smart Cities Design <i>Ond ej P ibyl, Michal Matowicki Ond ej P ibyl Ond ej P ibyl (Gar.)</i>	Z,ZK	6	3P+2C	L	P

17SCAR	Sustainable Cities and Regions	Z,ZK	3	2P+1C	L	P
14CITS	C-ITS Systems <i>Zden k Lokaj, Tomáš Zelinka, Miroslav Vaniš Zden k Lokaj Zden k Lokaj (Gar.)</i>	Z,ZK	6	3P+3C	L	P
14MIM	Microsimulation Models <i>Jan Král Jan Král Jan Král (Gar.)</i>	KZ	3	0P+3C	L	P
20ITSR	ITS - R <i>Martin Leso Martin Leso (Gar.)</i>	Z,ZK	3	2P+1C	L	P
14PAM	Programming and modelling <i>Vít Fábera, Tomáš Brandejský, Marek Kalika, Martin Fiala Vít Fábera Vít Fábera (Gar.)</i>	Z,ZK	4	2P+2C	L	P
14PD	Data processing <i>Miroslav Vaniš, Martin Šrotý Martin Šrotý Martin Šrotý (Gar.)</i>	Z,ZK	6	2P+4C	L	P
14PPRP	Computer Aided Project Management <i>Marek Kalika Marek Kalika Marek Kalika (Gar.)</i>	KZ	2	0P+2C	L	P
20BITS	Safety and reliability of ITS Systems <i>Tomáš Tichý, Vladimír Faltus</i>	KZ	3	2P+1C	L	P

Characteristics of the courses of this group of Study Plan: Code=2.S.NPSC UTEP 20/21 Name=2.s.nav.prez 20/21 SC: p edm ty z SC+IS(EN) pro ty, kte í 11SMCD nebo 17SCAR absolvují na UTEP

11SMCD	Smart Cities Design	Z,ZK	6
Introduction to smart cities, systém analysis and design fundamentals, usage of UML for system design, principles of complex systems, modeling using multiagent systems in the SW environment AnyLogic, application on a small scale real world problem.			
17SCAR	Sustainable Cities and Regions	Z,ZK	3
Cities in antiquity and in the middle ages, renaissance ideal of a perfect city, 19. and 20. century cities, modern city planning, sustainability as a concept, historical development of transportation in cities, modern transportation systems, logistics as a concept, supply chain, logistics center, city logistics.			
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 functionality 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 broadened 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.			
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.			
14PAM	Programming and modelling	Z,ZK	4
Object oriented programming, dynamic memory allocation, inheritance, generic programming, STL, abstract data types, programming techniques, recursion, complexity, Lindenmeyer's grammars, parallelism in nature and in real systems, parallel computer systems, parallel 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 situation			

Code of the group: 2.S.NPSC VYB 20/21

Name of the group: 2.s.nav.prez 20/21 výb r p edm tu - program SC

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
16SHMI	Simulation and HMI <i>Stanislav Novotný, Tereza Kunclová, Michal Cenkrner</i>	Z,ZK	3	2P+1C	L	P
17AMOL	Application of Operations Research Methods in Logistics <i>Alena Rybíková, Josef Volek Alena Rybíková (Gar.)</i>	Z,ZK	3	2P+1C	L	P

Characteristics of the courses of this group of Study Plan: Code=2.S.NPSC VYB 20/21 Name=2.s.nav.prez 20/21 výb r p edm tu - program SC

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.			
17AMOL	Application of Operations Research Methods in Logistics	Z,ZK	3
Exact, heuristic, metaheuristic methods. Static and dynamic shortest path problem. Location analysis, P&R/K&R facilities location. Travelling salesman problem with constraints. Assignment problem and matching algorithms. Decision making in urban transport. Design of urban transport lines. Scheduling in public transport.			

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 2

The role of the block: PV

Code of the group: 1.S.NPSC FA 20/21

Name of the group: 1.s.nav.prez (od) 20/21 - program SC - p edm ty z FA

Requirement credits in the group: In this group you have to gain at least 2 credits (at most 7)

Requirement courses in the group: In this group you have to complete at least 1 course (at most 3)

Credits in the group: 2

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
500EKL3	Ecology III - Social Ecology <i>Petr Klápšt Petr Klápšt Petr Klápšt (Gar.)</i>	KZ	2	2P+0C	Z	PV
500U3	Urbanism III - Theory	ZK	2	1P+1C	Z	PV
555UP1	Planning 1 - Urban Planning <i>Petr Klápšt , Jakub Vorel, Karel Maier Jakub Vorel Jakub Vorel (Gar.)</i>	ZK	3	2P+1C	Z	PV

Characteristics of the courses of this group of Study Plan: Code=1.S.NPSC FA 20/21 Name=1.s.nav.prez (od) 20/21 - program SC - p edm ty z FA

500EKL3	Ecology III - Social Ecology	KZ	2
Social Ecology: The subject deals with the relationship of man and the environment in landscape and settlements. It acquaints students with selected methods of socio-ecological research and participation of citizens in the formation of the rural environment, the city and its socio-spatial structure. The theoretical part of the subject is based on concrete practical examples, which are processed by the students and present them during the semester.			
500U3	Urbanism III - Theory	ZK	2
The course introduces the student to the most important urban theories and ways of thinking about the city from the 19th century to the present. In lectures and seminars, the student is led to think critically in order to be able to analyze, evaluate, compare and recognize the practical effects of these theories on the development of European cities.			
555UP1	Planning 1 - Urban Planning	ZK	3
In the course of Urban Planning I, we teach students on how the cities were planned from ancient times to the present and how discipline itself have evolved in the course of time. By using the real examples, we describe urban planning as a complex process with numerous feedbacks that evolves in time and involves various actors with different values and interests and resources. The course presents general principles and concepts of European spatial planning and planning system in the Czech Republic providing students with practical insight into relevant planning documents, legislation and institutions. Special lectures focus on actual topics: planning of urban ecosystems and participatory planning. At the end of the semester students will be evaluated based on the presentation and discussion of their seminar work via TEAMS or in classroom. In their seminar works students will analyse and critically evaluate selected case of planning process in one of the following domains: Urban mobility, Housing, Public services, Ecosystems, Economic activities, Cultural heritage.			

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
Stochastic modelling, estimation, prediction, filtration, control, methods of data analysis: k-means, DBSCAN, naive Bayes, decision trees, support vector machine.			
11SMCD	Smart Cities Design	Z,ZK	6
Introduction to smart cities, systém analysis and design fundamentals, usage of UML for system design, principles of complex systems, modeling using multiagent systems in the SW environment AnyLogic, application on a small scale real world problem.			
11XN1C	Thesis 1	Z	4
11XN2C	Thesis 2	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.			

12XN1C	Thesis 1	Z	4
12XN2C	Thesis 2	Z	4
14CISC	Cyber Infrastructure for Smart Cities Status quo and trends in telecommunications systems applied in cyber infrastructure, technical, economical and legal aspects of telecommunications networks design and services provisioning, identification and quantification of hierarchical telecommunications networks and services performance, telecommunication services dedicated for transport and specifically Smart Cities solutions.	Z,ZK	3
14CITS	C-ITS Systems Detailed description of C-ITS systems architecture, description of use-cases - urban and rural applications, principles of C-ITS functionality 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.	Z,ZK	6
14FCL	Future Cities Laboratory Future cities system architecture (with focus on C-ITS) and reference projects, functional and technology solutions description and principles, wireless telco solutions dedicated for C-ITS systems (ITS-G5, LTE-V, etc.), security architecture, data security and personal data protection, testing of the systems and functional parameters assessment, technical properties evaluation, methods of data collection and processing.	KZ	3
14MIM	Microsimulation Models Basic knowledge of traffic modeling and simulation will be broadened 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.	KZ	3
14PAM	Programming and modelling Object oriented programming, dynamic memory allocation, inheritance, generic programming, STL, abstract data types, programming techniques, recursion, complexity, Lindenmeyer's grammars, parallelism in nature and in real systems, parallel computer systems, parallel 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.	Z,ZK	4
14PD	Data processing 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.	Z,ZK	6
14PPRP	Computer Aided Project Management What is the project? The basic terms and 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.	KZ	2
14XN1C	Thesis 1	Z	4
14XN2C	Thesis 2	Z	4
15XN1C	Thesis 1	Z	4
15XN2C	Thesis 2	Z	4
16DITS	Vehicles within ITS 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.	Z,ZK	4
16ESDP	Electronic systems in modern vehicles 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.	Z,ZK	3
16KSD	Quality and reliability in area of transportation means and systems 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.	Z,ZK	3
16SHMI	Simulation and HMI 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.	Z,ZK	3
16XN1C	Thesis 1	Z	4
16XN2C	Thesis 2	Z	4
17AMOL	Application of Operations Research Methods in Logistics Exact, heuristic, metaheuristic methods. Static and dynamic shortest path problem. Location analysis, P&R/K&R facilities location. Travelling salesman problem with constraints. Assignment problem and matching algorithms. Decision making in urban transport. Design of urban transport lines. Scheduling in public transport.	Z,ZK	3
17PJM	Project Management Basic terms of the project management, project management standards, organizational structures and processes in the project management, life-cycle of the project, risk analysis, projects in transport and transport infrastructure and their specifics, feasibility study and CBA, project evaluation, PPP projects.	KZ	2
17SCAR	Sustainable Cities and Regions Cities in antiquity and in the middle ages, renaissance ideal of a perfect city, 19. and 20. century cities, modern city planning, sustainability as a concept, historical development of transportation in cities, modern transportation systems, logistics as a concept, supply chain, logistics center, city logistics.	Z,ZK	3
17SCF	Smart Cities Fundamentals The main smart city components will be described (intelligent transport systems, smart grids, smart buildings, smart lighting, e-governance, etc.) together with their integration methods by using existing international standards to achieve the synergies among different sectors. The quality of life for different city residents is understood as the main criterion function.	Z,ZK	6
17SU	Smart Urbanism Urban metabolism and ecology, urban morphology and land use, urban society: demography, mobility, social transition, urban space and places, urban flows, urban modeling, impact of technology innovations on urban transition.	Z,ZK	6

17TSC	Technologies for Smart Cities	Z,ZK	6
Each presented technology will be described through performance parameters like safety, reliability, integrity, continuity, etc. New business models of technologies' implementation and operation will be introduced to provide advanced deployment decision-making. Legal aspects of technologies' assessment (e.g. GDPR) will be presented for selected application areas.			
17XN1C	Thesis 1	Z	4
17XN2C	Thesis 2	Z	4
18XN1C	Thesis 1	Z	4
18XN2C	Thesis 2	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 situation			
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.			
20XN1C	Thesis 1	Z	4
20XN2C	Thesis 2	Z	4
21XN1C	Thesis 1	Z	4
21XN2C	Thesis 2	Z	4
22XN1C	Thesis 1	Z	4
22XN2C	Thesis 2	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			
23XN1C	Thesis 1	Z	4
23XN2C	Thesis 2	Z	4
500EKL3	Ecology III - Social Ecology	KZ	2
Social Ecology: The subject deals with the relationship of man and the environment in landscape and settlements. It acquaints students with selected methods of socio-ecological research and participation of citizens in the formation of the rural environment, the city and its socio-spatial structure. The theoretical part of the subject is based on concrete practical examples, which are processed by the students and present them during the semester.			
500U3	Urbanism III - Theory	ZK	2
The course introduces the student to the most important urban theories and ways of thinking about the city from the 19th century to the present. In lectures and seminars, the student is led to think critically in order to be able to analyze, evaluate, compare and recognize the practical effects of these theories on the development of European cities.			
555UP1	Planning 1 - Urban Planning	ZK	3
In the course of Urban Planning I, we teach students on how the cities were planned from ancient times to the present and how discipline itself have evolved in the course of time. By using the real examples, we describe urban planning as a complex process with numerous feedbacks that evolves in time and involves various actors with different values and interests and resources. The course presents general principles and concepts of European spatial planning and planning system in the Czech Republic providing students with practical insight into relevant planning documents, legislation and institutions. Special lectures focus on actual topics: planning of urban ecosystems and participatory planning. At the end of the semester			

students will be evaluated based on the presentation and discussion of their seminar work via TEAMS or in classroom. In their seminar works students will analyse and critically evaluate selected case of planning process in one of the following domains: Urban mobility, Housing, Public services, Ecosystems, Economic activities, Cultural heritage.

For updated information see <http://bilakniha.cvut.cz/en/FF.html>

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