Study plan

Name of study plan: navaz. mag. PRE program SC 22/23 (pro studenty, kteří absolvují některé předměty 1.roč. 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 21/22
Name of the group: Projekty nav.prez.1.-2.sem (od) 21/22 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)*** *Tutors,* ***authors*** *and guarantors (gar.)*	**Completion**	**Credits**	**Scope**	**Semester**	**Role**
11XN1C-E	**Thesis 1**	Z	4	0P+4C	Z	ZP
12XN1C-E	**Thesis 1**	Z	4	0P+4C	Z	ZP
14XN1C-E	**Thesis 1**	Z	4	0P+4C	Z	ZP
15XN1C-E	**Thesis 1**	Z	4	0P+4C	Z	ZP
16XN1C-E	**Thesis 1**	Z	4	0P+4C	Z	ZP
17XN1C-E	**Thesis 1** *Tomáš Horák, Miroslav Svítek*	Z	4	0P+4C	Z	ZP
18XN1C-E	**Thesis 1** *Afdhal Afdhal*	Z	4	0P+4C	Z	ZP
20XN1C-E	**Thesis 1**	Z	4	0P+4C	Z	ZP
21XN1C-E	**Thesis 1**	Z	4	0P+4C	Z	ZP
22XN1C-E	**Thesis 1**	Z	4	0P+4C	Z	ZP
23XN1C-E	**Thesis 1**	Z	4	0P+4C	Z	ZP
11XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP
12XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP
14XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP
15XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP
16XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP
17XN2C-E	**Thesis 2** *Tomáš Horák, Miroslav Svítek*	Z	4	0P+4C	L	ZP
18XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP
20XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP
21XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP
22XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP
23XN2C-E	**Thesis 2**	Z	4	0P+4C	L	ZP

Characteristics of the courses of this group of Study Plan: Code=XN SC 1-2 21/22 Name=Projekty nav.prez.1.-2.sem (od) 21/22 na FD programu SC

11XN1C-E	Thesis 1	Z	4
12XN1C-E	Thesis 1	Z	4
14XN1C-E	Thesis 1	Z	4
15XN1C-E	Thesis 1	Z	4
16XN1C-E	Thesis 1	Z	4
17XN1C-E	Thesis 1	Z	4
18XN1C-E	Thesis 1	Z	4
20XN1C-E	Thesis 1	Z	4
21XN1C-E	Thesis 1	Z	4
22XN1C-E	Thesis 1	Z	4
23XN1C-E	Thesis 1	Z	4
11XN2C-E	Thesis 2	Z	4
12XN2C-E	Thesis 2	Z	4
14XN2C-E	Thesis 2	Z	4
15XN2C-E	Thesis 2	Z	4
16XN2C-E	Thesis 2	Z	4
17XN2C-E	Thesis 2	Z	4
18XN2C-E	Thesis 2	Z	4
20XN2C-E	Thesis 2	Z	4
21XN2C-E	Thesis 2	Z	4
22XN2C-E	Thesis 2	Z	4
23XN2C-E	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 21/22
Name of the group: 1.s.nav.prez (od) 21/22 - program SC - ostatní předměty FD pro studenty UTEP
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)*** *Tutors,* ***authors*** *and guarantors (gar.)*	**Completion**	**Credits**	**Scope**	**Semester**	**Role**
20AIMI-E	**Application of ITS in Urban Engineering** *Josef Filip, Jiří Růžička, Tomáš Tichý*	Z,ZK	6	3P+3C	Z	P
20GINS-E	**Geographical, information, localization and navigation systems** *Petr Bureš, František Kekula, Pavel Hrubeš, Zuzana Purkrábková*	Z,ZK	6	3P+3C	Z	P

Characteristics of the courses of this group of Study Plan: Code=1.S.NPSC FD 21/22 Name=1.s.nav.prez (od) 21/22 - program SC - ostatní předměty FD pro studenty UTEP

20AIMI-E	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-E	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 21/22
Name of the group: 1.s.nav.prez (od) 21/22 SC:předměty z SC+IS(EN) pro ty, kteří 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)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
17SCF-E	**Smart Cities Fundamentals** *Tomáš Horák, Miroslav Svítek*	Z,ZK	6	3P+2C	Z	P
17TSC-E	**Technologies for Smart Cities** *Tomáš Horák, Miroslav Svítek*	Z,ZK	6	3P+2C	Z	P
11MAI-E	**ITS Mathematical Tools** *Jan Přikryl* ***Jan Přikryl*** *Jan Přikryl (Gar.)*	Z,ZK	4	2P+2C	Z	P
12TDP-E	**Traffic Flow Theory** *Vladimír Faltus*	Z,ZK	3	2P+1C	Z	P
16ESDP-E	**Electronic systems in modern vehicles** *Dmitrij Rožděstvenský, Petr Bouchner*	Z,ZK	3	2P+1C	Z	P
20MZZ-E	**Modern techniques of safety control of moving railway vehicles** *Martin Leso*	Z,ZK	3	2P+1C	Z	P
16DITS-E	**Vehicles within ITS** *David Lehet, Jaroslav Machan*	Z,ZK	4	2P+2C	Z	P
20TSJ-E	**Telematic systems and their design** *Petr Bureš, Ondřej Přibyl*	Z,ZK	6	3P+2C	Z	P
23TBSS-E	**Technology and Security of Sensor Networks** *Václav Jirovský* ***Václav Jirovský*** *Václav Jirovský (Gar.)*	KZ	2	2P+0C	Z	P
11MMAD-E	**Mathematical Methods for Data Analysis** *Magdalena Hykšová, Ivan Nagy* ***Magdalena Hykšová*** *Magdalena Hykšová (Gar.)*	Z,ZK	6	3P+3C	Z	P
16KSD-E	**Quality and reliability in area of transportation means and systems** *David Lehet, Jaroslav Machan*	Z,ZK	3	2P+1C	Z	P
20PRZP-E	**Computer aided railway traffic control** *Dušan Kamenický*	Z,ZK	3	2P+1C	Z	P
20TVHD-E	**Telematics in Public Transport** *Milan Sliacky*	Z,ZK	3	2P+1C	Z	P
20SYIN-E	**System Engineering** *Zuzana Bělinová*	Z,ZK	6	4P+2C	Z	P
20HEI-E	**Evaluation and Economics of ITS** *Jakub Rajnoch*	KZ	3	2P+1C	Z	P

Characteristics of the courses of this group of Study Plan: Code=1.S.NPSC UTEP 21/22 Name=1.s.nav.prez (od) 21/22 SC:předměty z SC+IS(EN) pro ty, kteří 17SCF nebo 17TSC absolvují na UTEP

17SCF-E	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-E	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-E	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-E	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-E	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-E	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-E	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-E	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-E	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-E	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.			

16KSD-E	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-E	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-E	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-E	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-E	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 21/22
Name of the group: 2.s.nav.prez (od) 21/22 - program SC pro studenty UTEP (předměty 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)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
14CISC-E	**Cyber Infrastructure for Smart Cities** *Tomáš Zelinka, Martin Šrotýř, Zdeněk Lokaj* ***Tomáš Zelinka*** *Tomáš Zelinka (Gar.)*	Z,ZK	3	2P+1C	L	P
17SU-E	**Smart Urbanism** *Jakub Vorel Jakub Vorel (Gar.)*	Z,ZK	6	2P+3C	L	P
14FCL-E	**Future Cities Laboratory** *Miroslav Svítek Miroslav Svítek (Gar.)*	KZ	3	0P+3C	L	P
17PJMG-E	**Project Management** *Alena Rybičková, Lucie Vicherková, Eliška Glaserová Alena Rybičková (Gar.)*	KZ	2	2P+0C	L	P

Characteristics of the courses of this group of Study Plan: Code=2.S.NPSC FD 21/22 Name=2.s.nav.prez (od) 21/22 - program SC pro studenty UTEP (předměty FD)

14CISC-E	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-E	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-E	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 evaluaiton, methods of data collection and processing.			
17PJMG-E	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 21/22
Name of the group: 2.s.nav.prez(od)21/22 SC:předměty z SC+IS(EN) pro ty, kteří 11SMCD-E nebo 17SCAR-E 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)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
11SMCD-E	**Smart Cities Design** *Ondřej Přibyl, Michal Matowicki, Jana Kuklová* ***Jana Kuklová*** *Ondřej Přibyl (Gar.)*	Z,ZK	6	3P+2C	L	P
17SCAR-E	**Sustainable Cities and Regions** *Tomáš Horák, Karel Maier Tomáš Horák (Gar.)*	Z,ZK	3	2P+1C	L	P
14CITS-E	**C-ITS Systems** *Tomáš Zelinka, Zdeněk Lokaj, Miroslav Vaniš Zdeněk Lokaj (Gar.)*	Z,ZK	6	3P+3C	L	P
14MIM-E	**Microsimulation Models** *Jan Mejstřík Jan Mejstřík (Gar.)*	KZ	3	0P+3C	L	P
20ITSR-E	**ITS - R** *Martin Leso Martin Leso (Gar.)*	Z,ZK	3	2P+1C	L	P
14PAM-E	**Programming and modelling** *Vít Fábera, Tomáš Brandejský, Marek Kalika, Martin Fiala Vít Fábera (Gar.)*	Z,ZK	4	2P+2C	L	P
14PD-E	**Data processing** *Martin Šrotýř, Miroslav Vaniš Michal Jeřábek (Gar.)*	Z,ZK	6	2P+4C	L	P
14PPRP-E	**Computer Aided Project Management** *Marek Kalika Marek Kalika (Gar.)*	KZ	2	0P+2C	L	P
20BITS-E	**Safety and reliability of ITS Systems** *Tomáš Tichý, Vladimír Faltus Tomáš Tichý (Gar.)*	KZ	3	2P+1C	L	P

Characteristics of the courses of this group of Study Plan: Code=2.S.NPSC UTEP 21/22 Name=2.s.nav.prez(od)21/22 SC:předměty z SC+IS(EN) pro ty, kteří 11SMCD-E nebo 17SCAR-E absolvují na UTEP

11SMCD-E	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-E	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-E	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-E	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.			
20ITSR-E	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-E	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-E	Data processing	Z,ZK	6
Advanced SQL and its procedural extensions, data pre-processing, datamining, interpretation of datamining result, Big Data, Big Data processing, data warehousing, unstructured data and NoSQL database.			
14PPRP-E	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-E	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: 2.S.NPSC VYB 21/22
Name of the group: 2.s.nav.prez (od) 21/22 výběr předmětu - program SC (studium všech předmětů na ČVUT)
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
16SHMI-E	**Simulation and HMI** *Petr Bouchner, Stanislav Novotný, Tereza Kunclová, Michal Cenkner Stanislav Novotný (Gar.)*	Z,ZK	3	2P+1C	L	P
17AMOL-E	**Application of Operations Research Methods in Logistics** *Alena Rybičková, Šárka Voráčová Alena Rybičková (Gar.)*	Z,ZK	3	2P+1C	L	P

Characteristics of the courses of this group of Study Plan: Code=2.S.NPSC VYB 21/22 Name=2.s.nav.prez (od) 21/22 výběr předmětu - program SC (studium všech předmětů na ČVUT)

16SHMI-E	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-E	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 - předměty 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)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
500EKL3	**Ecology III - Social Ecology** *Petr Klápště* ***Petr Klápště*** *Petr Klápště (Gar.)*	KZ	2	2P+0C	Z	PV
500U3	**Urbanism III - Theory**	ZK	2	1P+1C	Z	PV
555UP1	**Planning 1 - Urban Planning** *Jakub Vorel, Karel Maier, Petr Klápště* ***Jakub Vorel*** *Jakub Vorel (Gar.)*	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 - předměty 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
Close links between architecture and urban planning are typical for Central and Southern Europe. While in e.g. the UK, the USA and Canada planning is a fully independent profession, most planners in the Czech Republic have an architectural background. This may enrich both architecture and planning as multi-disciplinary professions. Man and the environment. Planning, the environment and designing. Planning before planners. Medieval European towns. Planning in the Industrial Era. Comprehensive planning. European great projects in the 20th century. Challenges for planning in modern and post-modern eras. Analyses for plan-making. Land-use planning and its contemporary issues. European spatial planning. A case of planning and development – Prague I. A case of planning and development – Prague II. Sustainability and planning. Role of a planner. Planning ethics. Presentation of seminar papers (essays).			

List of courses of this pass:

Code	Name of the course	Completion	Credits
11MAI-E	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-E	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.			
11SMCD-E	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-E	Thesis 1	Z	4
11XN2C-E	Thesis 2	Z	4
12TDP-E	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-E	Thesis 1	Z	4
12XN2C-E	Thesis 2	Z	4
14CISC-E	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.			
14CITS-E	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.			
14FCL-E	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 evaluaiton, methods of data collection and processing.			
14MIM-E	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-E	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-E	Data processing	Z,ZK	6
Advanced SQL and its procedural extensions, data pre-processing, datamining, interpretation of datamining result, Big Data, Big Data processing, data warehousing, unstructured data and NoSQL database.			
14PPRP-E	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.			
14XN1C-E	Thesis 1	Z	4
14XN2C-E	Thesis 2	Z	4
15XN1C-E	Thesis 1	Z	4
15XN2C-E	Thesis 2	Z	4
16DITS-E	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-E	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-E	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-E	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.			
16XN1C-E	Thesis 1	Z	4
16XN2C-E	Thesis 2	Z	4
17AMOL-E	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.			
17PJMG-E	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.			

17SCAR-E	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.			
17SCF-E	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.			
17SU-E	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.			
17TSC-E	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-E	Thesis 1	Z	4
17XN2C-E	Thesis 2	Z	4
18XN1C-E	Thesis 1	Z	4
18XN2C-E	Thesis 2	Z	4
20AIMI-E	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-E	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-E	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-E	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-E	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-E	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-E	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-E	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-E	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-E	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-E	Thesis 1	Z	4
20XN2C-E	Thesis 2	Z	4
21XN1C-E	Thesis 1	Z	4
21XN2C-E	Thesis 2	Z	4
22XN1C-E	Thesis 1	Z	4
22XN2C-E	Thesis 2	Z	4
23TBSS-E	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-E	Thesis 1	Z	4
23XN2C-E	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
Close links between architecture and urban planning are typical for Central and Southern Europe. While in e.g. the UK, the USA and Canada planning is a fully independent profession, most planners in the Czech Republic have an architectural background. This may enrich both architecture and planning as multi-disciplinary professions. Man and the environment. Planning, the environment and designing. Planning before planners. Medieval European towns. Planning in the Industrial Era. Comprehensive planning. European great projects in the 20th century. Challenges for planning in modern and post-modern eras. Analyses for plan-making. Land-use planning and its contemporary issues. European spatial planning. A case of planning and development – Prague I. A case of planning and development – Prague II. Sustainability and planning. Role of a planner. Planning ethics. Presentation of seminar papers (essays).			

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