

# Study plan

**Name of study plan: IS-EN nav.prez.16/17**

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch:

Program of study: Technology in Transportation and Telecommunications

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: Semestrální projekt

Minimal number of credits of the block: 16

The role of the block: ZP

Code of the group: XN IS 1.-4. 13/14

Name of the group: Projekt oboru IS 1.-4.sem. od 13/14 (pro N3710)

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 4 courses

Credits in the group: 16

Note on the group:

| Code  | Name of the course / Name of the group of courses<br>(in case of groups of courses the list of codes of their members)<br>Tutors, authors and guarantors (gar.)      | Completion | Credits | Scope    | Semester | Role |
|-------|--|------------|---------|----------|----------|------|
| 11XN1 | <b>Master Project 1</b>  | Z          | 2       | 0P+2C+4B | Z        | ZP   |
| 11XN2 | <b>Master Project 2</b>  | Z          | 2       | 0P+2C+8B | L        | ZP   |
| 11X13 | <b>Master Project 3</b>  | Z          | 4       | 0P+5C    | Z        | ZP   |
| 11XN4 | <b>Master Project 4</b>  | Z          | 8       | 0P+4C    | L        | ZP   |
| 12XN1 | <b>Master Project 1</b><br>Zuzana arská, Kristýna Neubergová, Iva Šturmová, Martin Jacura, Tomáš Javoík, Lukáš Týfa, Jiří arský, Josef Kocourek, Tomáš Padlek, ..... | Z          | 2       | 0P+2C+4B | Z        | ZP   |
| 12XN2 | <b>Master Project 2</b><br>Zuzana arská, Martin Jacura, Tomáš Javoík, Lukáš Týfa, Jiří arský, Josef Kocourek, Tomáš Padlek, Vojtěch Novotný, Petr Kumpošt, .....     | Z          | 2       | 0P+2C+8B | L        | ZP   |
| 12X13 | <b>Master Project 3</b>  | Z          | 4       | 0P+5C    | Z        | ZP   |
| 12XN4 | <b>Master Project 4</b><br>Zuzana arská, Martin Jacura, Tomáš Javoík, Lukáš Týfa, Jiří arský, Josef Kocourek, Tomáš Padlek, Vojtěch Novotný, Petr Kumpošt, .....     | Z          | 8       | 0P+4C    | L        | ZP   |
| 14XN1 | <b>Master Project 1</b><br>Tomáš Brandejský, Vít Fábera, Mária Jánešová, Jan Zelenka   | Z          | 2       | 0P+2C+4B | Z        | ZP   |
| 14XN2 | <b>Master Project 2</b><br>Tomáš Brandejský, Vít Fábera, Mária Jánešová, Jan Zelenka Vít Fábera (Gar.)   | Z          | 2       | 0P+2C+8B | L        | ZP   |
| 14X13 | <b>Master Project 3</b>  | Z          | 4       | 0P+5C    | Z        | ZP   |
| 14XN4 | <b>Master Project 4</b><br>Tomáš Brandejský, Vít Fábera, Mária Jánešová, Jan Zelenka   | Z          | 8       | 0P+4C    | L        | ZP   |
| 15XN1 | <b>Master Project 1</b>  | Z          | 2       | 0P+2C+4B | Z        | ZP   |
| 15XN2 | <b>Master Project 2</b>  | Z          | 2       | 0P+2C+8B | L        | ZP   |
| 15X13 | <b>Master Project 3</b>  | Z          | 4       | 0P+5C    | Z        | ZP   |
| 15XN4 | <b>Master Project 4</b>  | Z          | 8       | 0P+4C    | L        | ZP   |
| 16XN1 | <b>Master Project 1</b><br>Josef Mík, Josef Svoboda, P emysl Toman, Dmitrij Rožd stvenský  | Z          | 2       | 0P+2C+4B | Z        | ZP   |
| 16XN2 | <b>Master Project 2</b><br>Josef Mík, P emysl Toman, Petr Bouchner   | Z          | 2       | 0P+2C+8B | L        | ZP   |
| 16X13 | <b>Master Project 3</b>  | Z          | 4       | 0P+5C    | Z        | ZP   |
| 16XN4 | <b>Master Project 4</b>  | Z          | 8       | 0P+4C    | L        | ZP   |

|       |   |   |   |          |   |    |
|-------|---|---|---|----------|---|----|
| 17XN1 | <b>Master Project 1</b><br><i>Václav Baroch, Edvard B ezina, Michal Drábek, Alexandra Dvo áková, Veronika Faifrová, Tomáš Horák, Vít Janoš, Milan K iž, Olga Mertlová, .....</i>          | Z | 2 | 0P+2C+4B | Z | ZP |
| 17XN2 | <b>Master Project 2</b><br><i>Václav Baroch, Edvard B ezina, Michal Drábek, Veronika Faifrová, Tomáš Horák, Vít Janoš, Milan K iž, Olga Mertlová, Zden k Michl, .....</i>                 | Z | 2 | 0P+2C+8B | L | ZP |
| 17X13 | <b>Master Project 3</b>   | Z | 4 | 0P+5C    | Z | ZP |
| 17XN4 | <b>Master Project 4</b><br><i>Václav Baroch, Edvard B ezina, Michal Drábek, Alexandra Dvo áková, Veronika Faifrová, Tomáš Horák, Vít Janoš, Milan K iž, Olga Mertlová, .....</i>          | Z | 8 | 0P+4C    | L | ZP |
| 18XN1 | <b>Master Project 1</b><br><i>Radim Dvo ák, Jaroslav Valach, Daniel Kytý, Petr Koudelka, Tomáš Fíla, Jan Šlechrt, Ján Kopa ka, Radek Kolman</i>   | Z | 2 | 0P+2C+4B | Z | ZP |
| 18XN2 | <b>Master Project 2</b><br><i>Jaroslav Valach, Daniel Kytý, Tomáš Fíla, Petr Zlámal <b>Daniel Kytý</b> Daniel Kytý (Gar.)</i>   | Z | 2 | 0P+2C+8B | L | ZP |
| 18X13 | <b>Master Project 3</b>   | Z | 4 | 0P+5C    | Z | ZP |
| 18XN4 | <b>Master Project 4</b>   | Z | 8 | 0P+4C    | L | ZP |
| 20XN1 | <b>Master Project 1</b><br><i>Ji í R ži ka, Patrik Horaž ovský</i>  | Z | 2 | 0P+2C+4B | Z | ZP |
| 20XN2 | <b>Master Project 2</b><br><i>Patrik Horaž ovský <b>Vladimír Faltus</b></i>   | Z | 2 | 0P+2C+8B | L | ZP |
| 20X13 | <b>Master Project 3</b><br><i><b>Vladimír Faltus</b></i>  | Z | 4 | 0P+5C    | Z | ZP |
| 20XN4 | <b>Master Project 4</b><br><i>Ji í R ži ka, Žuzana B linová</i>   | Z | 8 | 0P+4C    | L | ZP |
| 21XN1 | <b>Master Project 1</b><br><i>Peter Vittek, Vladimír Socha, Andrej Lališ, Stanislav Kušmírek, Anna Polánecká, Milan Kameník, Jakub Kraus, Slobodan Stoji , Terézia Pilmannová, .....</i>  | Z | 2 | 0P+2C+4B | Z | ZP |
| 21XN2 | <b>Master Project 2</b><br><i>Peter Vittek, Andrej Lališ, Jakub Kraus, Slobodan Stoji , Terézia Pilmannová, Lenka Hanáková, Jakub Hospodka, Natalia Guskova, Kate ina Grötschelová</i>    | Z | 2 | 0P+2C+8B | L | ZP |
| 21X13 | <b>Master Project 3</b>   | Z | 4 | 0P+5C    | Z | ZP |
| 21XN4 | <b>Master Project 4</b><br><i>Peter Vittek, Andrej Lališ, Stanislav Kušmírek, Anna Polánecká, Jakub Kraus, Slobodan Stoji , Terézia Pilmannová, Lenka Hanáková, Jakub Hospodka, .....</i> | Z | 8 | 0P+4C    | L | ZP |
| 22XN1 | <b>Master Project 1</b><br><i>Tomáš Mi unek, Michal Frydrýn, Karel Kocián, Luboš Nouzovský, Zden k Svatý</i>  | Z | 2 | 0P+2C+4B | Z | ZP |
| 22XN2 | <b>Master Project 2</b><br><i>Michal Frydrýn, Karel Kocián, Luboš Nouzovský, Zden k Svatý, Jakub Nová ek</i>  | Z | 2 | 0P+2C+8B | L | ZP |
| 22X13 | <b>Master Project 3</b>   | Z | 4 | 0P+5C    | Z | ZP |
| 22XN4 | <b>Master Project 4</b><br><i>Michal Frydrýn, Karel Kocián, Luboš Nouzovský, Zden k Svatý, Jakub Nová ek</i>  | Z | 8 | 0P+4C    | L | ZP |
| 23XN1 | <b>Master Project 1</b>   | Z | 2 | 0P+2C+4B | Z | ZP |
| 23XN2 | <b>Master Project 2</b>   | Z | 2 | 0P+2C+8B | L | ZP |
| 23X13 | <b>Master Project 3</b>   | Z | 4 | 0P+5C    | Z | ZP |
| 23XN4 | <b>Master Project 4</b>   | Z | 8 | 0P+4C    | L | ZP |

**Characteristics of the courses of this group of Study Plan: Code=XN IS 1.-4. 13/14 Name=Projekt oboru IS 1.-4.sem. od 13/14 (pro N3710)**

|       |                  |   |   |
|-------|------------------|---|---|
| 11XN1 | Master Project 1 | Z | 2 |
| 11XN2 | Master Project 2 | Z | 2 |
| 11X13 | Master Project 3 | Z | 4 |
| 11XN4 | Master Project 4 | Z | 8 |
| 12XN1 | Master Project 1 | Z | 2 |
| 12XN2 | Master Project 2 | Z | 2 |
| 12X13 | Master Project 3 | Z | 4 |
| 12XN4 | Master Project 4 | Z | 8 |
| 14XN1 | Master Project 1 | Z | 2 |
| 14XN2 | Master Project 2 | Z | 2 |
| 14X13 | Master Project 3 | Z | 4 |
| 14XN4 | Master Project 4 | Z | 8 |
| 15XN1 | Master Project 1 | Z | 2 |
| 15XN2 | Master Project 2 | Z | 2 |
| 15X13 | Master Project 3 | Z | 4 |
| 15XN4 | Master Project 4 | Z | 8 |
| 16XN1 | Master Project 1 | Z | 2 |
| 16XN2 | Master Project 2 | Z | 2 |
| 16X13 | Master Project 3 | Z | 4 |
| 16XN4 | Master Project 4 | Z | 8 |

|       |                  |   |   |
|-------|------------------|---|---|
| 17XN1 | Master Project 1 | Z | 2 |
| 17XN2 | Master Project 2 | Z | 2 |
| 17X13 | Master Project 3 | Z | 4 |
| 17XN4 | Master Project 4 | Z | 8 |
| 18XN1 | Master Project 1 | Z | 2 |
| 18XN2 | Master Project 2 | Z | 2 |
| 18X13 | Master Project 3 | Z | 4 |
| 18XN4 | Master Project 4 | Z | 8 |
| 20XN1 | Master Project 1 | Z | 2 |
| 20XN2 | Master Project 2 | Z | 2 |
| 20X13 | Master Project 3 | Z | 4 |
| 20XN4 | Master Project 4 | Z | 8 |
| 21XN1 | Master Project 1 | Z | 2 |
| 21XN2 | Master Project 2 | Z | 2 |
| 21X13 | Master Project 3 | Z | 4 |
| 21XN4 | Master Project 4 | Z | 8 |
| 22XN1 | Master Project 1 | Z | 2 |
| 22XN2 | Master Project 2 | Z | 2 |
| 22X13 | Master Project 3 | Z | 4 |
| 22XN4 | Master Project 4 | Z | 8 |
| 23XN1 | Master Project 1 | Z | 2 |
| 23XN2 | Master Project 2 | Z | 2 |
| 23X13 | Master Project 3 | Z | 4 |
| 23XN4 | Master Project 4 | Z | 8 |

Name of the block: Compulsory courses

Minimal number of credits of the block: 104

The role of the block: Z

Code of the group: 1.S.NPIS 14/15 EN

Name of the group: 1.sem.nav.prez.IS 14/15 angli tina

Requirement credits in the group: In this group you have to gain 28 credits

Requirement courses in the group: In this group you have to complete 8 courses

Credits in the group: 28

Note on the group:

| Code   | Name of the course / Name of the group of courses<br>(in case of groups of courses the list of codes of their members)<br><i>Tutors, authors and guarantors (gar.)</i> | Completion | Credits | Scope | Semester | Role |
|--------|--|------------|---------|-------|----------|------|
| 11MAI  | <b>ITS Mathematical Tools</b><br><i>Jan P ikryl Jan P ikryl Jan P ikryl (Gar.)</i>   | Z,ZK       | 4       | 2P+2C | Z        | z    |
| 11TEF  | <b>Theoretical Physics at Transportation</b>   | Z,ZK       | 3       | 2P+1C | Z        | z    |
| 12TDP  | <b>Traffic Flow Theory</b><br><i>Vladimír Faltus</i>   | Z,ZK       | 3       | 2P+1C | Z        | z    |
| 20SK   | <b>Signals and Codes</b>   | Z,ZK       | 4       | 2P+1C | Z        | z    |
| 20TRAS | <b>Control and Reliability Theory in Transportation</b>  | ZK         | 4       | 4P+0C | Z        | z    |
| 20TSJ  | <b>Telematic systems and their design</b><br><i>Martin Langr, Pavel Hrubeš</i>   | Z,ZK       | 6       | 3P+2C | Z        | z    |
| 23IB   | <b>Information Security</b>  | KZ         | 2       | 2P+0C | Z        | z    |
| 16EAP  | <b>Energy Analysis of Land Carriage</b>  | KZ         | 2       | 2P+0C | Z        | z    |

Characteristics of the courses of this group of Study Plan: Code=1.S.NPIS 14/15 EN Name=1.sem.nav.prez.IS 14/15 angli tina

|       |                                       |      |   |   |
|-------|---------------------------------------|------|---|---|
| 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.   |
| 11TEF | Theoretical Physics at Transportation | Z,ZK | 3 | Generalized coordinates, Lagrange's equations of the first and the second kind, Hamilton's canonical equations, Canonical transformations, ergodic system, Weekly nonintegrable Hamilton's system, Chaos, Potential flow, Circumfluence of cylinder, conformal transformation, and method of singularity, Laminar flow, Turbulent flow.   |
| 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. |

|   |  |      |   |
|---|--|------|---|
| 20SK  | Signals and Codes                                | Z,ZK | 4 |
| Time and frequency representation of signals. Discretization of signals, sampling, quantization and coding. Signal transmission, modulation and coding. Coding theory, information theory. Checksums and selfcorrecting codes. Cryptography protocols. MATLAB exercises. Practical applications of coding and modulation.   |  |      |   |
| 20TRAS  | Control and Reliability Theory in Transportation | ZK   | 4 |
| Advanced methods of automatic control. Methods of state space control, nonlinear control, adaptive control, fuzzy control and stochastic control. Application of these methods on vehicular control and the control of traffic flows. Predictive diagnostics, safety in the traffic vehicles, safety infrastructure, human in the transportation and traffic systems and application of safety systems in transportation. |  |      |   |
| 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.   |  |      |   |
| 23IB  | Information Security                             | KZ   | 2 |
| Essentials of the security, definitions, approach. Security in networked branches, systems and networks - security point of view, Risks and their assesment, effect of security on the system design.   |  |      |   |
| 16EAP   | Energy Analysis of Land Carriage                 | KZ   | 2 |
| Dynamics and driving resistance of the vehicle. Types of energy - kinetic, static, thermic, chemical etc. Means of energy transformation into kinetic. Combustion engine, electric engine, steam engine, air engine. Energy accumulation means, flywheel, fuel cell. Energy recuperation. WTW energetic analysis.   |  |      |   |

Code of the group: 2.S.NPIS 13/14

Name of the group: 2.sem.nav.prez.IS 13/14

Requirement credits in the group: In this group you have to gain 28 credits

Requirement courses in the group: In this group you have to complete 11 courses

Credits in the group: 28

Note on the group:

| Code   | Name of the course / Name of the group of courses<br>(in case of groups of courses the list of codes of their members)<br><i>Tutors, authors and guarantors (gar.)</i> | Completion | Credits | Scope | Semester | Role |
|--------|--|------------|---------|-------|----------|------|
| 11RZ1  | Pattern Recognition 1  | Z,ZK       | 3       | 2P+1C | L        | Z    |
| 11ZDA  | Data Processing  | Z,ZK       | 3       | 2P+1C | L        | Z    |
| 14TITS | Telecommunications in ITS  | Z,ZK       | 3       | 2P+1C | L        | Z    |
| 14UES  | Artificial Intelligence and Expert Systems in Transport  | ZK         | 2       | 2P+0C | L        | Z    |
| 20ARR  | Risk Analysis and Management   | Z,ZK       | 2       | 1P+1C | L        | Z    |
| 23IV   | Intelligent Vehicle and Safety   | Z,ZK       | 2       | 1P+1C | L        | Z    |
| 20EMI  | Economy and Management of ITS Projects   | KZ         | 3       | 2P+1C | L        | Z    |
| 14DMS  | Traffic Modelling and Simulation   | Z          | 4       | 1P+3C | L        | Z    |
| 16TAJ  | Technological Aspects of Quality   | Z          | 2       | 2P+0C | L        | Z    |
| 20IDFS | Identification Systems   | Z          | 2       | 2P+0C | L        | Z    |
| 22APN  | Analysis and Prevention of Traffic Accidents   | Z          | 2       | 1P+1C | L        | Z    |

Characteristics of the courses of this group of Study Plan: Code=2.S.NPIS 13/14 Name=2.sem.nav.prez.IS 13/14

|  |   |      |   |
|--|---|------|---|
| 11RZ1  | Pattern Recognition 1                                   | Z,ZK | 3 |
| Elements of pattern recognition. Basic PR concepts. Bayesian decision theory. Learning theory. Parametric classifiers. Context classifiers. Classification quality estimation. Vector support machines. Non-parametric classifiers. Feature selection. Cluster analysis.   |   |      |   |
| 11ZDA  | Data Processing   | Z,ZK | 3 |
| Specific problems of the field of processing of traffic data. Data preprocessing and analysis for use in additional applications.  |   |      |   |
| 14TITS   | Telecommunications in ITS                               | Z,ZK | 3 |
| Specific legislative conditions for telecommunications solutions designed for ITS systems, quantification of telecommunications system parameters, relation between telematic (ITS) and telecommunications performance indicators, available tools for management of required telecommunications performance indicators limits namely within the data IP based networks, Typical data telecommunications solutions (backbone and access) applied within ITS. |   |      |   |
| 14UES  | Artificial Intelligence and Expert Systems in Transport | ZK   | 2 |
| Introduction to artificial intelligence, work in unified state space and with related techniques.  |   |      |   |
| 20ARR  | Risk Analysis and Management                            | Z,ZK | 2 |
| The main focus of the course is to acquaint with the analysis, evaluation and control of risks in road transport, especially in relation to the tunnels. They are presented probabilistic and deterministic methods for risk assessment, human behavior in crisis situations and factors that influence it. Students are more familiar with tunnel technology and repeats the basic concepts of the theory of traffic flow.                                  |   |      |   |
| 23IV   | Intelligent Vehicle and Safety                          | Z,ZK | 2 |
| Content of the subject are basic terms, types of traffic injuries, restraint systems, injury biomechanics, active and passive safety.  |   |      |   |
| 20EMI  | Economy and Management of ITS Projects                  | KZ   | 3 |
| The course presents basic theoretical knowledge for ITS effectiveness assesment in a lot of typical projects. The course covers methodology to obtain economy and financial models and their mutual synthesis to provide basis for feasibility studies for ITS implementation. It includes basic methods of project management with respect to the organizational and legislative aspects of ITS projects.   |   |      |   |
| 14DMS  | Traffic Modelling and Simulation                        | Z    | 4 |
| Introduction to the tools for traffic simulation. Parameter modification and tuning, application in praxis.  |   |      |   |
| 16TAJ  | Technological Aspects of Quality                        | Z    | 2 |
| Certification and accreditation, quality management, standards of quality management and its application, quality system creation, tools and methods of quality improvement, conformity assurance, environmental certification, workplace certification, QMS integration, classification, certification of products and producers.   |   |      |   |

|   |  |   |   |
|---|--|---|---|
| 20IDFS  | Identification Systems                       | Z | 2 |
| Basic identification systems, its technologies (barcodes, RFID, biometrics), their features, usage, security and standards. Applications of identification systems, e. g. identification of vehicles, cargo, devices and processes. Identifier as foundation of traffic telematics standardization. |  |   |   |
| 22APN   | Analysis and Prevention of Traffic Accidents | Z | 2 |
| Basic definitions, types of source materials, methods of analysis, influence of road, factors of accidents, vehicle faults etc.   |  |   |   |

Code of the group: 3.S.NPIS 13/14 EN

Name of the group: 3.sem.nav.prez. IS 13/14 angli tina

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 7 courses

Credits in the group: 22

Note on the group:

| Code   | Name of the course / Name of the group of courses<br>(in case of groups of courses the list of codes of their members)<br>Tutors, authors and guarantors (gar.) | Completion | Credits | Scope     | Semester | Role |
|--------|---|------------|---------|-----------|----------|------|
| 11MMJ  | <b>Mathematical Models and their Applications</b><br>Evženie Uglickich, Pavla Pecherková Evženie Uglickich (Gar.)   | Z,ZK       | 4       | 2P+2C+12B | Z        | z    |
| 20GIL  | <b>Geographical, Information, Localization and Navigation systems</b>   | Z,ZK       | 6       | 2P+2C     | Z        | z    |
| 20SYN  | <b>System Engineering</b>   | Z,ZK       | 3       | 2P+1C     | Z        | z    |
| 12BA   | <b>Road Safety Audit</b>  | KZ         | 2       | 2P+0C     | Z        | z    |
| 20HITS | <b>ITS Effectiveness Assessment</b>   | KZ         | 2       | 2P+0C     | Z        | z    |
| 12DZP  | <b>Transport and Environment</b>  | Z          | 2       | 2P+0C     | Z        | z    |
| 16MRJ  | <b>Modelling of "Human - Machine" Interface</b>   | Z          | 3       | 2P+1C     | Z        | z    |

Characteristics of the courses of this group of Study Plan: Code=3.S.NPIS 13/14 EN Name=3.sem.nav.prez. IS 13/14 angli tina

|  |  |      |   |
|--|--|------|---|
| 11MMJ  | Mathematical Models and their Applications                     | Z,ZK | 4 |
| System. Regression, discrete and logistic models. Bayesian estimation of model parameters. Parameter estimation of normal regression, discrete and logistic models. Classification with logistic model. One-step and multi-step prediction with regression and discrete models. State model. State estimation. Kalman filter. Control with regression and discrete models.   |  |      |   |
| 20GIL  | Geographical, Information, Localization and Navigation systems | Z,ZK | 6 |
| Introduction to GIS, model of real world, data structure for spatial data, methods if data input, digitalisation, geographics coordination systems, map projection, vector data form, raster data form, spatial relationships and algorithms, general GIS tasks, transportation domain, GIS applications. Main principles of localization, satellite localization, performance parameters, processing of positioning data, digital cartographic data for navigation, navigation systems, dynamical navigation systems, applications of navigation systems. |  |      |   |
| 20SYN  | System Engineering   | Z,ZK | 3 |
| Enlarged definition of system in space of engineer tasks, specification of selected types of systems versus linked tools of system analysis and projection, acquaintance with selected instruments of identification of complicated systems, specifying of selected types of system engineering tasks. Examples of system engineering's practical methods and tools.   |  |      |   |
| 12BA   | Road Safety Audit  | KZ   | 2 |
| Schedules of applications of safety assessments during the process of preparations, and of the particular realization of the road network that should minimize traffic accident risks for all those who take part in road traffic. Road safety survey. Application of European Directive 2008/96/EC on road safety infrastructure management.  |  |      |   |
| 20HITS   | ITS Effectiveness Assessment                                   | KZ   | 2 |
| The course presents the knowledge of strategical plans, feasibility studies of ITS systems implementation based on available information together with the assessment of different phases of ITS project.  |  |      |   |
| 12DZP  | Transport and Environment                                      | Z    | 2 |
| This course aims the impact of transport on environment. The accent is put mainly on noise and vibration, emission, barrier effect and energy demands. The noise measury is part and parcel of this course.  |  |      |   |
| 16MRJ  | Modelling of "Human - Machine" Interface                       | Z    | 3 |
| Aspects of human -machine interaction. Summary of areas where HMI takes an important place in particular in transportation. Examples of vehicle simulators.  |  |      |   |

Code of the group: 3.S.NPIS-V1-12/13

Name of the group: 3.sem.obor IS 1.výb r p edm t od 12/13 (pro N3710)

Requirement credits in the group: In this group you have to gain 2 credits

Requirement courses in the group: In this group you have to complete 1 course

Credits in the group: 2

Note on the group:

| Code  | Name of the course / Name of the group of courses<br>(in case of groups of courses the list of codes of their members)<br>Tutors, authors and guarantors (gar.) | Completion | Credits | Scope | Semester | Role |
|-------|---|------------|---------|-------|----------|------|
| 16VS  | <b>Vehicle Control Systems</b>  | Z,ZK       | 2       | 1P+1C | Z        | z    |
| 20PTA | <b>Advanced Telematic Applications</b>  | Z,ZK       | 2       | 1P+1C | Z        | z    |
| 20ZZZ | <b>Railway Interlocking Systems</b>   | Z,ZK       | 2       | 1P+1C | Z        | z    |

Characteristics of the courses of this group of Study Plan: Code=3.S.NPIS-V1-12/13 Name=3.sem.obor IS 1.výb r p edm t od 12/13 (pro N3710)

|   |                                 |      |   |
|---|---------------------------------|------|---|
| 16VS  | Vehicle Control Systems         | Z,ZK | 2 |
| Basic features of regulatory technology and theory of control. Elementary regulators (PID), dynamic properties of a vehicle and driver as a regulator. Combustion engine control, static engine optimization, control unit requirements. Electric driver and its components. DC devices, asynchronous engines, synchronous engines - principles, construction, elementary features and operation. Hybrid drive control to obtain the optimal efficiency. Car communication bus (CAN, LIN, FlexRay, IObus, KWP2000 protocols etc). Control, safety, communication and comfort electronic systems in a car. The practice is performed with real and simulated systems, car system communication, laboratory experiments and control on selected electric devices. |                                 |      |   |
| 20PTA   | Advanced Telematic Applications | Z,ZK | 2 |
| The course presents basic knowledge and description of ITS systems and services for public transport, e.g. for public transport companies, for users of public transport, for public transport integrators, etc. and or freight transport, e.g. dangerous goods transport, transport of animals, etc.   |                                 |      |   |
| 20ZZZ   | Railway Interlocking Systems    | Z,ZK | 2 |
| This course reassume on the course "Railway interlocking plants". With basic knowledge about parts Railway interlocking plants, this course describes function and concept railway interlocking systems. The main aim is observe on modern electronic systems and other systems with high level of railway control automation. Deal of this course will be focused on interoperability of control and command in railway.   |                                 |      |   |

Code of the group: 3.S.NPIS-V2-12/13

Name of the group: 3.sem.obor IS 2.výb r p edm t od 12/13 (pro N3710)

Requirement credits in the group: In this group you have to gain 2 credits

Requirement courses in the group: In this group you have to complete 1 course

Credits in the group: 2

Note on the group:

| Code  | Name of the course / Name of the group of courses<br>(in case of groups of courses the list of codes of their members)<br>Tutors, authors and guarantors (gar.) | Completion | Credits | Scope | Semester | Role |
|-------|---|------------|---------|-------|----------|------|
| 14BKA | <b>Safety Critical Applications in ITS</b><br>Tomáš Brandejský  | KZ         | 2       | 2P+0C | Z        | z    |
| 18STC | <b>Special Materials and Technology</b><br>Jaroslav Valach  | KZ         | 2       | 2P+0C | Z        | z    |

Characteristics of the courses of this group of Study Plan: Code=3.S.NPIS-V2-12/13 Name=3.sem.obor IS 2.výb r p edm t od 12/13 (pro N3710)

|  |                                     |    |   |
|--|-------------------------------------|----|---|
| 14BKA  | Safety Critical Applications in ITS | KZ | 2 |
| The need of system solution of HW and SW safety, partial specifics of safety, methods of safe systems development and safety proving. Introduction into legislative framework. |                                     |    |   |
| 18STC  | Special Materials and Technology    | KZ | 2 |
| Basic Classification of Materials. Semiconductors. Ceramic materials. Polymers. Special kinds of Steels. Properties of Composite Materials.                                    |                                     |    |   |

Code of the group: XNDPIS 13/14

Name of the group: Diplomová práce obor IS od 13/14

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 1 course

Credits in the group: 22

Note on the group:

| Code   | Name of the course / Name of the group of courses<br>(in case of groups of courses the list of codes of their members)<br>Tutors, authors and guarantors (gar.) | Completion | Credits | Scope  | Semester | Role |
|--------|---|------------|---------|--------|----------|------|
| 12XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 11XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 14XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 15XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 16XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 23XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 18XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 20XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 21XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 22XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |
| 17XIDP | <b>Diploma Thesis (for the Field IS)</b>  | KZ         | 22      | 0P+24C | L        | z    |

Characteristics of the courses of this group of Study Plan: Code=XNDPIS 13/14 Name=Diplomová práce obor IS od 13/14

|        |                                   |    |    |
|--------|-----------------------------------|----|----|
| 12XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |
| 11XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |
| 14XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |
| 15XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |

|        |                                   |    |    |
|--------|-----------------------------------|----|----|
| 16XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |
| 23XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |
| 18XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |
| 20XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |
| 21XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |
| 22XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |
| 17XIDP | Diploma Thesis (for the Field IS) | KZ | 22 |

### List of courses of this pass:

| Code   | Name of the course  | Completion | Credits |
|--------|---|------------|---------|
| 11MAI  | ITS Mathematical Tools<br>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.   | Z,ZK       | 4       |
| 11MMJ  | Mathematical Models and their Applications<br>System. Regression, discrete and logistic models. Bayesian estimation of model parameters. Parameter estimation of normal regression, discrete and logistic models. Classification with logistic model. One-step and multi-step prediction with regression and discrete models. State model. State estimation. Kalman filter. Control with regression and discrete models.  | Z,ZK       | 4       |
| 11RZ1  | Pattern Recognition 1<br>Elements of pattern recognition. Basic PR concepts. Bayesian decision theory. Learning theory. Parametric classifiers. Context classifiers. Classification quality estimation. Vector support machines. Non-parametric classifiers. Feature selection. Cluster analysis.   | Z,ZK       | 3       |
| 11TEF  | Theoretical Physics at Transportation<br>Generalized coordinates, Lagrange's equations of the first and the second kind, Hamilton's canonical equations, Canonical transformations, ergodic system, Weekly nonintegrable Hamilton's system, Chaos, Potential flow, Circumfluence of cylinder, conformal transformation, and method of singularity, Laminar flow, Turbulent flow.  | Z,ZK       | 3       |
| 11X13  | Master Project 3  | Z          | 4       |
| 11XIDP | Diploma Thesis (for the Field IS)   | KZ         | 22      |
| 11XN1  | Master Project 1  | Z          | 2       |
| 11XN2  | Master Project 2  | Z          | 2       |
| 11XN4  | Master Project 4  | Z          | 8       |
| 11ZDA  | Data Processing<br>Specific problems of the field of processing of traffic data. Data preprocessing and analysis for use in additional applications.  | Z,ZK       | 3       |
| 12BA   | Road Safety Audit<br>Schedules of applications of safety assessments during the process of preparations, and of the particular realization of the road network that should minimize traffic accident risks for all those who take part in road traffic. Road safety survey. Application of European Directive 2008/96/EC on road safety infrastructure management.  | KZ         | 2       |
| 12DZP  | Transport and Environment<br>This course aims the impact of transport on environment. The accent is put mainly on noise and vibration, emission, barrier effect and energy demands. The noise measury is part and parcel of this course.  | Z          | 2       |
| 12TDP  | Traffic Flow Theory<br>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.  | Z,ZK       | 3       |
| 12X13  | Master Project 3  | Z          | 4       |
| 12XIDP | Diploma Thesis (for the Field IS)   | KZ         | 22      |
| 12XN1  | Master Project 1  | Z          | 2       |
| 12XN2  | Master Project 2  | Z          | 2       |
| 12XN4  | Master Project 4  | Z          | 8       |
| 14BKA  | Safety Critical Applications in ITS<br>The need of system solution of HW and SW safety, partial specifics of safety, methods of safe systems development and safety proving. Introduction into legislative framework.   | KZ         | 2       |
| 14DMS  | Traffic Modelling and Simulation<br>Introduction to the tools for traffic simulation. Parameter modification and tuning, application in praxis.   | Z          | 4       |
| 14TITS | Telecommunications in ITS<br>Specific legislative conditions for telecommunications solutions designed for ITS systems, quantification of telecommunications system parameters, relation between telematic (ITS) and telecommunications performance indicators, available tools for management of required telecommunications performance indicators limits namely within the data IP based networks, Typical data telecommunications solutions (backbone and access) applied within ITS. | Z,ZK       | 3       |
| 14UES  | Artificial Intelligence and Expert Systems in Transport<br>Introduction to artificial intelligence, work in unified state space and with related techniques.  | ZK         | 2       |
| 14X13  | Master Project 3  | Z          | 4       |
| 14XIDP | Diploma Thesis (for the Field IS)   | KZ         | 22      |
| 14XN1  | Master Project 1  | Z          | 2       |
| 14XN2  | Master Project 2  | Z          | 2       |
| 14XN4  | Master Project 4  | Z          | 8       |
| 15X13  | Master Project 3  | Z          | 4       |
| 15XIDP | Diploma Thesis (for the Field IS)   | KZ         | 22      |
| 15XN1  | Master Project 1  | Z          | 2       |

|  |  |      |    |
|--|--|------|----|
| 15XN2  | Master Project 2   | Z    | 2  |
| 15XN4  | Master Project 4   | Z    | 8  |
| 16EAP  | Energy Analysis of Land Carriage                               | KZ   | 2  |
| Dynamics and driving resistance of the vehicle. Types of energy - kinetic, static, thermic, chemical etc. Means of energy transformation into kinetic. Combustion engine, electric engine, steam engine, air engine. Energy accumulation means, flywheel, fuel cell. Energy recuperation. WTW energetic analysis.  |  |      |    |
| 16MRJ  | Modelling of "Human - Machine" Interface                       | Z    | 3  |
| Aspects of human -machine interaction. Summary of areas where HMI takes an important place in particular in transportation. Examples of vehicle simulators.  |  |      |    |
| 16TAJ  | Technological Aspects of Quality                               | Z    | 2  |
| Certification and accreditation, quality management, standards of quality management and its application, quality system creation, tools and methods of quality improvement, conformity assurance, environmental certification, workplace certification, QMS integration, classification, certification of products and producers.   |  |      |    |
| 16VS   | Vehicle Control Systems  | Z,ZK | 2  |
| Basic features of regulatory technology and theory of control. Elementary regulators (PID), dynamic properties of a vehicle and driver as a regulator. Combustion engine control, static engine optimization, control unit requirements. Electric driver and its components. DC devices, asynchronous engines, synchronous engines - principles, construction, elementary features and operation. Hybrid drive control to obtain the optimal efficiency. Car communication bus (CAN, LIN, FlexRay, ISObus, KWP2000 protocols etc). Control, safety, communication and comfort electronic systems in a car. The practice is performed with real and simulated systems, car system communication, laboratory experiments and control on selected electric devices. |  |      |    |
| 16X13  | Master Project 3   | Z    | 4  |
| 16XIDP   | Diploma Thesis (for the Field IS)                              | KZ   | 22 |
| 16XN1  | Master Project 1   | Z    | 2  |
| 16XN2  | Master Project 2   | Z    | 2  |
| 16XN4  | Master Project 4   | Z    | 8  |
| 17X13  | Master Project 3   | Z    | 4  |
| 17XIDP   | Diploma Thesis (for the Field IS)                              | KZ   | 22 |
| 17XN1  | Master Project 1   | Z    | 2  |
| 17XN2  | Master Project 2   | Z    | 2  |
| 17XN4  | Master Project 4   | Z    | 8  |
| 18STC  | Special Materials and Technology                               | KZ   | 2  |
| Basic Classification of Materials. Semiconductors. Ceramic materials. Polymers. Special kinds of Steels. Properties of Composite Materials.  |  |      |    |
| 18X13  | Master Project 3   | Z    | 4  |
| 18XIDP   | Diploma Thesis (for the Field IS)                              | KZ   | 22 |
| 18XN1  | Master Project 1   | Z    | 2  |
| 18XN2  | Master Project 2   | Z    | 2  |
| 18XN4  | Master Project 4   | Z    | 8  |
| 20ARR  | Risk Analysis and Management                                   | Z,ZK | 2  |
| The main focus of the course is to acquaint with the analysis, evaluation and control of risks in road transport, especially in relation to the tunnels. They are presented probabilistic and deterministic methods for risk assessment, human behavior in crisis situations and factors that influence it. Students are more familiar with tunnel technology and repeats the basic concepts of the theory of traffic flow.  |  |      |    |
| 20EMI  | Economy and Management of ITS Projects                         | KZ   | 3  |
| The course presents basic theoretical knowledge for ITS effectiveness assessment in a lot of typical projects. The course covers methodology to obtain economy and financial models and their mutual synthesis to provide basis for feasibility studies for ITS implementation. It includes basic methods of project management with respect to the organizational and legislative aspects of ITS projects.  |  |      |    |
| 20GIL  | Geographical, Information, Localization and Navigation systems | Z,ZK | 6  |
| Introduction to GIS, model of real world, data structure for spatial data, methods of data input, digitalisation, geographics coordination systems, map projection, vector data form, raster data form, spatial relationships and algorithms, general GIS tasks, transportation domain, GIS applications. Main principles of localization, satellite localization, performance parameters, processing of positioning data, digital cartographic data for navigation, navigation systems, dynamical navigation systems, applications of navigation systems.   |  |      |    |
| 20HITS   | ITS Effectiveness Assessment                                   | KZ   | 2  |
| The course presents the knowledge of strategical plans, feasibility studies of ITS systems implementation based on available information together with the assessment of different phases of ITS project.  |  |      |    |
| 20IDFS   | Identification Systems   | Z    | 2  |
| Basic identification systems, its technologies (barcodes, RFID, biometrics), their features, usage, security and standards. Applications of identification systems, e. g. identification of vehicles, cargo, devices and processes. Identifier as foundation of traffic telematics standardization.  |  |      |    |
| 20PTA  | Advanced Telematic Applications                                | Z,ZK | 2  |
| The course presents basic knowledge and description of ITS systems and services for public transport, e.g. for public transport companies, for users of public transport, for public transport integrators, etc. and or freight transport, e.g. dangerous goods transport, transport of animals, etc.  |  |      |    |
| 20SK   | Signals and Codes  | Z,ZK | 4  |
| Time and frequency representation of signals. Discretization of signals, sampling, quantization and coding. Signal transmission, modulation and coding. Coding theory, information theory. Checksums and selfcorrecting codes. Cryptography protocols. MATLAB exercises. Practical applications of coding and modulation.  |  |      |    |
| 20SYN  | System Engineering   | Z,ZK | 3  |
| Enlarged definition of system in space of engineer tasks, specification of selected types of systems versus linked tools of system analysis and projection, acquaintance with selected instruments of identification of complicated systems, specifying of selected types of system engineering tasks. Examples of system engineering's practical methods and tools.   |  |      |    |
| 20TRAS   | Control and Reliability Theory in Transportation               | ZK   | 4  |
| Advanced methods of automatic control. Methods of state space control, nonlinear control, adaptive control, fuzzy control and stochastic control. Application of these methods on vehicular control and the control of traffic flows. Predictive diagnostics, safety in the traffic vehicles, safety infrastructure, human in the transportation and traffic systems and application of safety systems in transportation.  |  |      |    |
| 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.  |  |      |    |
| 20X13  | Master Project 3   | Z    | 4  |
| 20XIDP   | Diploma Thesis (for the Field IS)                              | KZ   | 22 |
| 20XN1  | Master Project 1   | Z    | 2  |



|        |   |      |    |
|--------|---|------|----|
| 20XN2  | Master Project 2  | Z    | 2  |
| 20XN4  | Master Project 4  | Z    | 8  |
| 20ZZZ  | Railway Interlocking Systems<br>This course reassume on the course "Railway interlocking plants". With basic knowledge about parts Railway interlocking plants, this course describes function and concept railway interlocking systems. The main aim is observe on modern electronic systems and other systems with high level of railway control automation. Deal of this course will be focused on interoperability of control and command in railway. | Z,ZK | 2  |
| 21X13  | Master Project 3  | Z    | 4  |
| 21XIDP | Diploma Thesis (for the Field IS)   | KZ   | 22 |
| 21XN1  | Master Project 1  | Z    | 2  |
| 21XN2  | Master Project 2  | Z    | 2  |
| 21XN4  | Master Project 4  | Z    | 8  |
| 22APN  | Analysis and Prevention of Traffic Accidents<br>Basic definitions, types of source materials, methods of analysis, influence of road, factors of accidents, vehicle faults etc.   | Z    | 2  |
| 22X13  | Master Project 3  | Z    | 4  |
| 22XIDP | Diploma Thesis (for the Field IS)   | KZ   | 22 |
| 22XN1  | Master Project 1  | Z    | 2  |
| 22XN2  | Master Project 2  | Z    | 2  |
| 22XN4  | Master Project 4  | Z    | 8  |
| 23IB   | Information Security<br>Essentials of the security, definitions, approach. Security in networked branches, systems and networks - security point of view, Riscs and their assesment, effect of security on the system design.   | KZ   | 2  |
| 23IV   | Intelligent Vehicle and Safety<br>Content of the subject are basic terms, types of traffic injuries, restraint systems, injury biomechanics, active and passive safety.   | Z,ZK | 2  |
| 23X13  | Master Project 3  | Z    | 4  |
| 23XIDP | Diploma Thesis (for the Field IS)   | KZ   | 22 |
| 23XN1  | Master Project 1  | Z    | 2  |
| 23XN2  | Master Project 2  | Z    | 2  |
| 23XN4  | Master Project 4  | Z    | 8  |

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