# Study plan

## Name of study plan: Open Informatics - Artificial Intelligence

Faculty/Institute/Others: Faculty of Electrical Engineering
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Open Informatics
Type of study: Follow-up master full-time
Required credits: 85
Elective courses credits: 35
Sum of credits in the plan: 120
Note on the plan:

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Name of the block: Compulsory courses in the program
Minimal number of credits of the block: 49
The role of the block: P

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Code of the group: 2018_MOIDIP
Name of the group: Diploma Thesis
Requirement credits in the group: In this group you have to gain 25 credits
Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 25
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 |
|---|---|---|---|---|---|---|
| BDIP25 | **Diploma Thesis** | Z | 25 | 22s | L | P |

**Characteristics of the courses of this group of Study Plan: Code=2018_MOIDIP Name=Diploma Thesis**

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|---|---|---|---|
| BDIP25 | Diploma Thesis | Z | 25 |

Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.

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Code of the group: 2018_MOIP
Name of the group: Compulsory subjects of the programm
Requirement credits in the group: In this group you have to gain 24 credits
Requirement courses in the group: In this group you have to complete 4 courses
Credits in the group: 24
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 |
|---|---|---|---|---|---|---|
| B4M35KO | **Combinatorial Optimization** *Zdeněk Hanzálek **Zdeněk Hanzálek** Zdeněk Hanzálek (Gar.)* | Z,ZK | 6 | 3P+2C | L | P |
| B4M33PAL | **Advanced algorithms** *Marko Genyk-Berezovskyj, Daniel Průša, Ondřej Drbohlav **Daniel Průša** Daniel Průša (Gar.)* | Z,ZK | 6 | 2P+2C | Z | P |
| B4MSVP | **Software or Research Project** *Ivan Jelínek, Jaroslav Sloup, Jiří Šebek, Martin Šipoš, Drahomíra Hejtmanová, Jana Zichová, Petr Pošík, Martin Hlinovský, Katarína Žmolíková, ..... **Ivan Jelínek** Ivan Jelínek (Gar.)* | KZ | 6 | | Z,L | P |
| B4M01TAL | **Theory of Algorithms** *Marie Demlová, Natalie Žukovec **Marie Demlová** Marie Demlová (Gar.)* | Z,ZK | 6 | 3P+2S | L | P |

**Characteristics of the courses of this group of Study Plan: Code=2018_MOIP Name=Compulsory subjects of the programm**

| | | | |
|---|---|---|---|
| B4M35KO | Combinatorial Optimization | Z,ZK | 6 |
| The goal is to show the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term operations research). Following the courses on linear algebra, graph theory, and basics of optimization, we show optimization techniques based on graphs, integer linear programming, heuristics, approximation algorithms and state space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, planning of human resources, scheduling in production lines, message routing, scheduling in parallel computers. | | | |
| B4M33PAL | Advanced algorithms | Z,ZK | 6 |
| Basic graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - pattern matching. | | | |
| B4MSVP | Software or Research Project | KZ | 6 |
| B4M01TAL | Theory of Algorithms | Z,ZK | 6 |
| The course brings theoretical background of the theory of algorithms with the focus at first on the time and space complexity of algorithms and problems, secondly on the correctness of algorithms. Further it is dealt with the theory of complexity; the classes P, NP, NP-complete, PSPACE and NPSPACE are treated and properties of them investigated. Probabilistic algorithms are studied and the classes RP and ZZP introduced. | | | |

Name of the block: Compulsory courses of the specialization
Minimal number of credits of the block: 36
The role of the block: PO

Code of the group: 2018_MOIPO7
Name of the group: Compulsory subjects of the branch
Requirement credits in the group: In this group you have to gain 36 credits
Requirement courses in the group: In this group you have to complete 6 courses
Credits in the group: 36
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** |
|---|---|---|---|---|---|---|
| B4M36LUP | **Logical Reasoning and Programming** *Ondřej Kuželka, Karel Chvalovský* ***Filip Železný*** *Filip Železný (Gar.)* | Z,ZK | 6 | 2P+2C | Z | PO |
| B4M36PUI | **Artificial Intelligence Planning** *Rostislav Horčík* ***Rostislav Horčík*** *Michal Pěchouček (Gar.)* | Z,ZK | 6 | 2P+2C | L | PO |
| BE4M33SSU | **Statistical Machine Learning** *Jan Drchal, Vojtěch Franc* ***Vojtěch Franc*** *Vojtěch Franc (Gar.)* | Z,ZK | 6 | 2P+2C | Z | PO |
| B4M36SMU | **Symbolic Machine Learning** *Ondřej Kuželka, Filip Železný, Gustav Šír* ***Ondřej Kuželka*** *Ondřej Kuželka (Gar.)* | Z,ZK | 6 | 2P+2C | L | PO |
| B4M36UIR | **Artificial Intelligence in Robotics** *Miloš Prágr, Jan Faigl* ***Jan Faigl*** *Jan Faigl (Gar.)* | Z,ZK | 6 | 2P+2C | Z | PO |
| B4M36MAS | **Computational Game Theory** *Tomáš Kroupa, Michal Jakob, Ondřej Kubíček, Tomáš Votroubek* ***Tomáš Kroupa*** *Michal Pěchouček (Gar.)* | Z,ZK | 6 | 2P+2C | Z | PO |

**Characteristics of the courses of this group of Study Plan: Code=2018_MOIPO7 Name=Compulsory subjects of the branch**

| | | | |
|---|---|---|---|
| B4M36LUP | Logical Reasoning and Programming | Z,ZK | 6 |
| The course's aim is to explain selected significant methods of computational logic. These include algorithms for propositional satisfiability checking, logical programming in Prolog, and first-order theorem proving and model-finding. Time permitting, we will also discuss some complexity and decidability issues pertaining to the said methods. | | | |
| B4M36PUI | Artificial Intelligence Planning | Z,ZK | 6 |
| The course covers the problematic of automated planning in artificial intelligence and focuses especially on domain independent models of planning problems: planning as a search in the space of states (state-space planning), in the space of plans (plan-space planning), heuristic planning, planning in graph representation of planning problems (graph-plan) or hierarchical planning. The students will also learn about the problematic of planning under uncertainty and the planning model as a decision-making in MDP and POMDP. | | | |
| BE4M33SSU | Statistical Machine Learning | Z,ZK | 6 |
| The aim of statistical machine learning is to develop systems (models and algorithms) for learning to solve tasks given a set of examples and some prior knowledge about the task. This includes typical tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning concepts such as risk minimisation, maximum likelihood estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification and regression and to show how they can be learned by those concepts. | | | |
| B4M36SMU | Symbolic Machine Learning | Z,ZK | 6 |
| This course consists of four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its environment, also known as reinforcement learning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inference. The third part will cover fundamental topics from natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Finally, the last part will provide an introduction to several topics from the computational learning theory, including the online and batch learning settings. | | | |
| B4M36UIR | Artificial Intelligence in Robotics | Z,ZK | 6 |
| The course aims to acquaint students with the use of planning approaches and decision-making techniques of artificial intelligence for solving problems arising in autonomous robotic systems. Students in the course are employing knowledge of planning algorithms, game theory, and solving optimization problems in selected application scenarios of mobile robotics. Students first learn architectures of autonomous systems based on reactive and behavioral models of autonomous systems. The considered application scenarios and robotic problems include path planning, persistent environmental monitoring, robotic exploration of unknown environments, online real-time decision-making, deconfliction in autonomous systems, and solutions of antagonistic conflicts. In laboratory exercises, students practice their problem formulations of robotic challenges and practical solutions in a realistic robotic simulator or consumer mobile robots. This course is also part of the inter-university programme prg.ai Minor. It pools the best of AI education in Prague to provide students with a deeper and broader insight into the field of artificial intelligence. More information is available at https://prg.ai/minor. | | | |

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| B4M36MAS | Computational Game Theory | Z,ZK | 6 |

This course is designed to introduce students to the fundamental concepts and applications of game theory, a powerful tool used to model strategic interactions among individuals, organizations, or countries. Throughout the course, we will delve into various aspects of game theory and explore its wide-ranging applications in diverse fields, including machine learning and AI.

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

Code of the group: 2018_MOIH
Name of the group: Humanities subjects
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group:

| Code | Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)* | Completion | Credits | Scope | Semester | Role |
|---|---|---|---|---|---|---|
| B0M16FIL | *Peter Zamarovský* ***Peter Zamarovský*** *Peter Zamarovský (Gar.)* | Z,ZK | 5 | 2P+2S | Z,L | v |
| B0M16HVT | **History of science and technology 2** *Marcela Efmertová, Jan Mikeš* ***Marcela Efmertová*** *Marcela Efmertová (Gar.)* | Z,ZK | 5 | 2P+2S | Z,L | v |
| B0M16HSD1 | **History of economy and social studies** ***Marcela Efmertová*** | Z,ZK | 5 | 2P+2S | Z,L | v |
| B0M16PSM | **Psychology** *Jan Fiala* ***Jan Fiala*** *Jan Fiala (Gar.)* | Z,ZK | 5 | 2P+2S | Z,L | v |
| B0M16TEO | **Theology** *Vladimír Slámečka* ***Vladimír Slámečka*** *Vladimír Slámečka (Gar.)* | Z,ZK | 5 | 2P+2S | Z,L | v |

**Characteristics of the courses of this group of Study Plan: Code=2018_MOIH Name=Humanities subjects**

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|---|---|---|---|
| B0M16FIL | | Z,ZK | 5 |
| B0M16HVT | History of science and technology 2 | Z,ZK | 5 |

This subject traces historical developments in electrical engineering branches in the world and in the Czech Lands. Its ultimate goal is to stimulate students' interest in the history and traditions of the subject, while highlighting the developments in technical education and professional organizations, the process of shaping scientific life and the influence of technical engineers

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|---|---|---|---|
| B0M16HSD1 | History of economy and social studies | Z,ZK | 5 |

This subject deals with the history of the Czech society in the 19th - 21th centuries. It follows the forming of the Czech political representation, its aims and achieved results as well as the social and cultural development and coexistence of the various ethnical groups in the Czech countries.

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|---|---|---|---|
| B0M16PSM | Psychology | Z,ZK | 5 |
| B0M16TEO | Theology | Z,ZK | 5 |

This subject provides to students the basic orientation in christian theology and requires no special previous education. After short philosophic lecture the basic theologic disciplines are gone through. The subject is determined not only to believer students who want to know the reliable theologic grounding but also above all to ones who want to get know Christianity - religion from which graws our civilization up.

Code of the group: MTV
Name of the group: Physical education
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group:

| Code | Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)* | Completion | Credits | Scope | Semester | Role |
|---|---|---|---|---|---|---|
| TVV | **Physical education** | Z | 0 | 0+2 | Z,L | v |
| A003TV | **Physical Education** ***Jiří Drnek*** | Z | 2 | 0+2 | L,Z | v |
| TV-V1 | **Physical education** | Z | 1 | 0+2 | Z,L | v |
| TVV0 | **Physical education** | Z | 0 | 0+2 | Z,L | v |
| TVKLV | **Physical Education Course** | Z | 0 | 7dní | L | v |
| TVKZV | **Physical Education Course** | Z | 0 | 7dní | Z | v |

**Characteristics of the courses of this group of Study Plan: Code=MTV Name=Physical education**

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|---|---|---|---|
| TVV | Physical education | Z | 0 |
| A003TV | Physical Education | Z | 2 |

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|---|---|---|---|
| TV-V1 | Physical education | Z | 1 |
| TVV0 | Physical education | Z | 0 |
| TVKLV | Physical Education Course | Z | 0 |
| TVKZV | Physical Education Course | Z | 0 |

Code of the group: 2018_MOIVOL
Name of the group: Elective subjects
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group: ~The offer of elective courses arranged by departments can be found on the website https://fel.cvut.cz/en/education/volitelne-predmety.html\\

## List of courses of this pass:

| Code | Name of the course | Completion | Credits |
|---|---|---|---|
| A003TV | Physical Education | Z | 2 |
| B0M16FIL | | Z,ZK | 5 |
| B0M16HSD1 | History of economy and social studies | Z,ZK | 5 |
| This subject deals with the history of the Czech society in the 19th - 21th centuries. It follows the forming of the Czech political representation, its aims and achieved results as well as the social and cultural development and coexistence of the various ethnical groups in the Czech countries. | | | |
| B0M16HVT | History of science and technology 2 | Z,ZK | 5 |
| This subject traces historical developments in electrical engineering branches in the world and in the Czech Lands. Its ultimate goal is to stimulate students' interest in the history and traditions of the subject, while highlighting the developments in technical education and professional organizations, the process of shaping scientific life and the influence of technical engineers | | | |
| B0M16PSM | Psychology | Z,ZK | 5 |
| B0M16TEO | Theology | Z,ZK | 5 |
| This subject provides to students the basic orientation in christian theology and requires no special previous education. After short philosophic lecture the basic theologic disciplines are gone through. The subject is determined not only to believer students who want to know the reliable theologic grounding but also above all to ones who want to get know Christianity - religion from which graws our civilization up. | | | |
| B4M01TAL | Theory of Algorithms | Z,ZK | 6 |
| The course brings theoretical background of the theory of algorithms with the focus at first on the time and space complexity of algorithms and problems, secondly on the correctness of algorithms. Further it is dealt with the theory of complexity; the classes P, NP, NP-complete, PSPACE and NPSPACE are treated and properties of them investigated. Probabilistic algorithms are studied and the classes RP and ZZP introduced. | | | |
| B4M33PAL | Advanced algorithms | Z,ZK | 6 |
| Basic graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - pattern matching. | | | |
| B4M35KO | Combinatorial Optimization | Z,ZK | 6 |
| The goal is to show the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term operations research). Following the courses on linear algebra, graph theory, and basics of optimization, we show optimization techniques based on graphs, integer linear programming, heuristics, approximation algorithms and state space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, planning of human resources, scheduling in production lines, message routing, scheduling in parallel computers. | | | |
| B4M36LUP | Logical Reasoning and Programming | Z,ZK | 6 |
| The course's aim is to explain selected significant methods of computational logic. These include algorithms for propositional satisfiability checking, logical programming in Prolog, and first-order theorem proving and model-finding. Time permitting, we will also discuss some complexity and decidability issues pertaining to the said methods. | | | |
| B4M36MAS | Computational Game Theory | Z,ZK | 6 |
| This course is designed to introduce students to the fundamental concepts and applications of game theory, a powerful tool used to model strategic interactions among individuals, organizations, or countries. Throughout the course, we will delve into various aspects of game theory and explore its wide-ranging applications in diverse fields, including machine learning and AI. | | | |
| B4M36PUI | Artificial Intelligence Planning | Z,ZK | 6 |
| The course covers the problematic of automated planning in artificial intelligence and focuses especially on domain independent models of planning problems: planning as a search in the space of states (state-space planning), in the space of plans (plan-space planning), heuristic planning, planning in graph representation of planning problems (graph-plan) or hierarchical planning. The students will also learn about the problematic of planning under uncertainty and the planning model as a decision-making in MDP and POMDP. | | | |
| B4M36SMU | Symbolic Machine Learning | Z,ZK | 6 |
| This course consists of four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its environment, also known as reinforcement learning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inference. The third part will cover fundamental topics from natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Finally, the last part will provide an introduction to several topics from the computational learning theory, including the online and batch learning settings. | | | |
| B4M36UIR | Artificial Intelligence in Robotics | Z,ZK | 6 |
| The course aims to acquaint students with the use of planning approaches and decision-making techniques of artificial intelligence for solving problems arising in autonomous robotic systems. Students in the course are employing knowledge of planning algorithms, game theory, and solving optimization problems in selected application scenarios of mobile robotics. Students first learn architectures of autonomous systems based on reactive and behavioral models of autonomous systems. The considered application scenarios and robotic problems include path planning, persistent environmental monitoring, robotic exploration of unknown environments, online real-time decision-making, deconfliction in autonomous systems, and solutions of antagonistic conflicts. In laboratory exercises, students practice their problem formulations of robotic challenges and practical solutions in a realistic robotic simulator or | | | |

| | | | |
|---|---|---|---|
| consumer mobile robots. This course is also part of the inter-university programme prg.ai Minor. It pools the best of AI education in Prague to provide students with a deeper and broader insight into the field of artificial intelligence. More information is available at https://prg.ai/minor. | | | |
| B4MSVP | Software or Research Project | KZ | 6 |
| BDIP25 | Diploma Thesis | Z | 25 |
| Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination. | | | |
| BE4M33SSU | Statistical Machine Learning | Z,ZK | 6 |
| The aim of statistical machine learning is to develop systems (models and algorithms) for learning to solve tasks given a set of examples and some prior knowledge about the task. This includes typical tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning concepts such as risk minimisation, maximum likelihood estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification and regression and to show how they can be learned by those concepts. | | | |
| TV-V1 | Physical education | Z | 1 |
| TVKLV | Physical Education Course | Z | 0 |
| TVKZV | Physical Education Course | Z | 0 |
| TVV | Physical education | Z | 0 |
| TVV0 | Physical education | Z | 0 |

For updated information see http://bilakniha.cvut.cz/en/f3.html
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