# Study plan

## Name of study plan: Open Informatics - Cyber Security

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**

| | | | |
|---|---|---|---|
| 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_MOIPO2
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** |
|---|---|---|---|---|---|---|
| B4M36BSY | **Introduction to Computer Security** *Sebastián García, Tomáš Pevný, Veronica Valeros, Maria Rigaki, Ondřej Lukáš, Martin Řepa, Lukáš Forst, Muris Sladić* ***Tomáš Pevný*** *Tomáš Pevný (Gar.)* | Z,ZK | 6 | 2P+2C | Z | PO |
| B4M36KBE | **Communications Security** *Tomáš Vaněk* ***Peter Macejko*** *Tomáš Vaněk (Gar.)* | Z,ZK | 6 | 3P+2C | L | PO |
| B4M01MKR | **Mathematical Cryptography** *Alena Gollová* ***Alena Gollová*** *Jiří Velebil (Gar.)* | Z,ZK | 6 | 4P+2S | L | PO |
| B2M32PST | **Advanced Networking Technologies** *Zbyněk Kocur, Leoš Boháč* ***Leoš Boháč*** *Leoš Boháč (Gar.)* | Z,ZK | 6 | 2P + 2C + 4D | Z | PO |
| B4M36SAN | **Statistical Data Analysis** *Jiří Kléma* ***Jiří Kléma*** *Jiří Kléma (Gar.)* | Z,ZK | 6 | 2P+2C | Z | PO |
| B4M36ZKS | **Software Quality Assurance** *Karel Frajták, Miroslav Bureš, Matěj Klíma* ***Miroslav Bureš*** *Miroslav Bureš (Gar.)* | Z,ZK | 6 | 2P+2C | Z | PO |

**Characteristics of the courses of this group of Study Plan: Code=2018_MOIPO2 Name=Compulsory subjects of the branch**

| | | | |
|---|---|---|---|
| B4M36BSY | Introduction to Computer Security | Z,ZK | 6 |
| This course aims to teach students cybersecurity fundamentals by combining penetration testing with defense strategies. Using an innovative blend of lectures and practical tutorials, students engage in highly interactive classes. Each new concept is immediately reinforced with hands-on exercises, allowing students to apply what they have learned in real-time. Throughout the semester, the course integrates both attack and defense techniques. In realistic scenarios accessed via a cyber range, students will practice a wide range of skills: reconnaissance, scanning, exploiting vulnerabilities, privilege escalation, lateral movement, exfiltration, malware analysis, network security forensics, binary reversing, log analysis, intrusion detection systems, honeypots, and applications of machine learning and AI in cybersecurity. Classes are in English. Teachers speak English, Czech, Spanish, Greek, and Bosnian. | | | |
| B4M36KBE | Communications Security | Z,ZK | 6 |
| The course provides a complete source of information on the field of security of information systems and information technologies. The most of information in today's world is created, transferred, stored in electronic form so information security is very important part of it. On successful completion of this course, students should be able to define the cryptographic primitives symmetric / asymmetric encryption, digital signatures, cryptographic hash function, and message authentication codes. They should be able to explain the security features offered by the latest versions of the most important security protocols operating on the TCP/IP stack (IPsec, TLS, SSH, PGP) and describe known attacks against these security protocols. | | | |
| B4M01MKR | Mathematical Cryptography | Z,ZK | 6 |
| The lecture sets mathematical foundations of modern cryptography (RSA, El-Gamal, elliptic curve cryptography). Related algorithms for primality testing, number factorisation and discrete logarithm are treated as well. | | | |
| B2M32PST | Advanced Networking Technologies | Z,ZK | 6 |
| Subject Advanced Network Technologies expands students' knowledge of modern network technologies. The course is practically oriented and focused on explaining the function of advanced network protocols as used in modern data networks of today and tomorrow. Students will gain practical experience with the issues like Internet routing, software-defined networks, multicast routing, IPv6, and MPLS networks. Part of the course is also devoted to a detailed explanation of transport protocols TCP/UDP and a manner in which software applications can access transportation services of TCP/IP data networks. | | | |
| B4M36SAN | Statistical Data Analysis | Z,ZK | 6 |
| This course builds on the skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly aims at multivariate statistical analysis and modelling, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a purely statistical counterpart to machine learning and data mining courses. | | | |
| B4M36ZKS | Software Quality Assurance | Z,ZK | 6 |

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**

| | | | |
|---|---|---|---|
| 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 | | | |
| 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. | | | |
| 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 |
| TV-V1 | **Physical education** | Z | 1 | 0+2 | Z,L | v |
| TVV0 | **Physical education** | Z | 0 | 0+2 | Z,L | v |
| TVKZV | **Physical Education Course** | Z | 0 | 7dní | Z | v |
| TVKLV | **Physical Education Course** | Z | 0 | 7dní | L | v |

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

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

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## List of courses of this pass:

| Code | Name of the course | Completion | Credits |
|---|---|---|---|
| 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. | | | |
| B2M32PST | Advanced Networking Technologies | Z,ZK | 6 |
| Subject Advanced Network Technologies expands students' knowledge of modern network technologies. The course is practically oriented and focused on explaining the function of advanced network protocols as used in modern data networks of today and tomorrow. Students will gain practical experience with the issues like Internet routing, software-defined networks, multicast routing, IPv6, and MPLS networks. Part of the course is also devoted to a detailed explanation of transport protocols TCP/UDP and a manner in which software applications can access transportation services of TCP/IP data networks. | | | |
| B4M01MKR | Mathematical Cryptography | Z,ZK | 6 |
| The lecture sets mathematical foundations of modern cryptography (RSA, El-Gamal, elliptic curve cryptography). Related algorithms for primality testing, number factorisation and discrete logarithm are treated as well. | | | |
| 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. | | | |
| B4M36BSY | Introduction to Computer Security | Z,ZK | 6 |
| This course aims to teach students cybersecurity fundamentals by combining penetration testing with defense strategies. Using an innovative blend of lectures and practical tutorials, students engage in highly interactive classes. Each new concept is immediately reinforced with hands-on exercises, allowing students to apply what they have learned in real-time. Throughout the semester, the course integrates both attack and defense techniques. In realistic scenarios accessed via a cyber range, students will practice a wide range of skills: reconnaissance, scanning, exploiting vulnerabilities, privilege escalation, lateral movement, exfiltration, malware analysis, network security forensics, binary reversing, log analysis, intrusion detection systems, honeypots, and applications of machine learning and AI in cybersecurity. Classes are in English. Teachers speak English, Czech, Spanish, Greek, and Bosnian. | | | |
| B4M36KBE | Communications Security | Z,ZK | 6 |
| The course provides a complete source of information on the field of security of information systems and information technologies. The most of information in today's world is created, transferred, stored in electronic form so information security is very important part of it. On successful completion of this course, students should be able to define the cryptographic primitives symmetric / asymmetric encryption, digital signatures, cryptographic hash function, and message authentication codes. They should be able to explain the security features offered by the latest versions of the most important security protocols operating on the TCP/IP stack (IPsec, TLS, SSH, PGP) and describe known attacks against these security protocols. | | | |
| B4M36SAN | Statistical Data Analysis | Z,ZK | 6 |
| This course builds on the skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly aims at multivariate statistical analysis and modelling, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a purely statistical counterpart to machine learning and data mining courses. | | | |
| B4M36ZKS | Software Quality Assurance | Z,ZK | 6 |
| 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. | | | |
| 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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