Study plan

Name of study plan: Erasmus Mundus Master Course - SpaceMaster 2024-2030

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: Cybernetics and Robotics
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: Compulsory courses in the program
Minimal number of credits of the block: 98
The role of the block: P

Code of the group: 2024_SPACEMASTER_P
Name of the group: Compulsory subjects of the programme
Requirement credits in the group: In this group you have to gain 98 credits
Requirement courses in the group: In this group you have to complete 11 courses
Credits in the group: 98
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
BDIP30	**Diploma Thesis**	Z	30	22s	L	P
BE3M35DRS	**Dynamics and Control of Networks** *Kristian Hengster-Movric* ***Kristian Hengster-Movric*** *Kristian Hengster-Movric (Gar.)*	Z,ZK	6	2P+2C	Z	P
BE3M35SRL	**Flight Control Systems** *Martin Hromčík* ***Martin Hromčík*** *Martin Hromčík (Gar.)*	Z,ZK	6	2P+2L	Z	P
BE3M35LSY1	**Linear Systems** *Petr Hušek* ***Petr Hušek*** *Petr Hušek (Gar.)*	Z,ZK	6	3P+2S	Z	P
BE3M35ORR	**Optimal and Robust Control** *Zdeněk Hurák* ***Zdeněk Hurák*** *Zdeněk Hurák (Gar.)*	Z,ZK	6	2P+2C	L	P
BE3MPROJ6	**Project**	Z	6	0p+6s	Z	P
BE3M35SPC	**Space Communication**	Z,ZK	8	2P+2S	Z	P
BE3M35SPI	**Space Instruments**	Z,ZK	8	2P+2S	L	P
BE3M35SPP	**Space Physics**	Z,ZK	7	2P+2S	Z	P
BE3M35SSD	**Spacecraft System**	Z,ZK	8	2P+2S	Z	P
BE3M35TSS	**The Solar System**	Z,ZK	7	2P+2S	Z	P

Characteristics of the courses of this group of Study Plan: Code=2024_SPACEMASTER_P Name=Compulsory subjects of the programme

BDIP30	Diploma Thesis	Z	30

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.

BE3M35DRS	Dynamics and Control of Networks	Z,ZK	6

This course responds to an ever-increasing demand for understanding contemporary networks large-scale complex systems composed of many components and subsystems interconnected into a single distributed entity. Herein, we will consider fundamental similarities between diverse areas such as e.g. forecasting the spread of global pandemics, public opinion dynamics and manipulation of communities through social media, formation controls for unmanned vehicles, energy generation and distribution in power grids, etc. Understanding such compelling issues goes far beyond the boundaries of any single physical, technological or scientific domain. Therefore, we will analyze phenomena across different domains, involving societal, economic and biological networks. For such networked systems, the resulting behavior depends not only on the characteristics of their individual components and details of their physical or logical interactions, but also on a precise way those components are interconnected the detailed interconnection topology. For that reason, the first part of the course introduces fundamental theoretical and abstract computational network analysis concepts; in particular, the algebraic graph theory, network measures and metrics and fundamental network algorithms. The second part of the course subsequently views networks as dynamical systems, studies their properties and ways in which these are controlled, using mainly methods of automatic control theory.

BE3M35SRL	Flight Control Systems	Z,ZK	6
The course is devoted to classical and modern control design techniques for autopilots and flight control systems. Particular levels are discussed, starting with the dampers attitude angle stabilizers, to guidance and navigation systems. Next to the design itself, important aspects of aircraft modelling, both as a rigid body and considering flexibility of the structure, are discussed			
BE3M35LSY1	Linear Systems	Z,ZK	6
The purpose of this course is to introduce mathematical tools for the description, analysis, and partly also synthesis, of dynamical systems. The focus will be on linear time-invariant multi-input multi-output systems and their properties such as stability, controllability, observability and state realization. State feedback, state estimation, and the design of stabilizing controllers will be explained in detail. Partially covered will be also time-varying and nonlinear systems. Some of the tools introduced in this course are readily applicable to engineering problems such as the analysis of controllability and observability in the design of flexible space structures, the design of state feedback in aircraft control, and the estimation of state variables. The main motivation, however, is to pave the way for the advanced courses of the study program. The prerequsites for this course include undergraduate level linear algebra, differential equations, and Laplace and z transforms.			
BE3M35ORR	Optimal and Robust Control	Z,ZK	6
This advanced course will be focused on design methods for optimal and robust control. Major emphasis will be put on practical computational skills and realistically complex problem assignments.			
BE3MPROJ6	Project	Z	6
BE3M35SPC	Space Communication	Z,ZK	8
BE3M35SPI	Space Instruments	Z,ZK	8
BE3M35SPP	Space Physics	Z,ZK	7
BE3M35SSD	Spacecraft System	Z,ZK	8
BE3M35TSS	The Solar System	Z,ZK	7

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 22
The role of the block: PV

Code of the group: 2024_SPACEMASTER_PV
Name of the group: Compulsory optionally subjects
Requirement credits in the group: In this group you have to gain at least 22 credits (at most 55)
Requirement courses in the group: In this group you have to complete at least 3 courses (at most 8)
Credits in the group: 22
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
BE3M35ELS	**Electronics in Space**	Z,ZK	8	2P+2S	L	PV
BE3M35ISRT	**Introduction to Spectroscopy and Radiative Transfer**	Z,ZK	8	2P+2S	Z	PV
BE3M35OCS	**Onboard Computer and Onboard Software**	Z,ZK	7	2P+2S	Z	PV
BE3M35PAT	**Polar Atmosphere**	Z,ZK	8	2P+2S	L	PV
BE3M35PSA	**Propulsion with Space Applications**	Z,ZK	7	2P+2S	L	PV
BE3M35SEP	**Space Engineering Project 1**	Z	7	2P+2S	Z	PV
BE3M35SEI	**Spacecraft Environment Interactions**	Z,ZK	7	2P+2S	L	PV
BE3M35SIS	**Swedish for International Students 1**	Z,ZK	3	2P+2S	Z	PV

Characteristics of the courses of this group of Study Plan: Code=2024_SPACEMASTER_PV Name=Compulsory optionally subjects

BE3M35ELS	Electronics in Space	Z,ZK	8
BE3M35ISRT	Introduction to Spectroscopy and Radiative Transfer	Z,ZK	8
BE3M35OCS	Onboard Computer and Onboard Software	Z,ZK	7
BE3M35PAT	Polar Atmosphere	Z,ZK	8
BE3M35PSA	Propulsion with Space Applications	Z,ZK	7
BE3M35SEP	Space Engineering Project 1	Z	7
BE3M35SEI	Spacecraft Environment Interactions	Z,ZK	7
BE3M35SIS	Swedish for International Students 1	Z,ZK	3

List of courses of this pass:

<table>
<tr><th>Code</th><th>Name of the course</th><th>Completion</th><th>Credits</th></tr>
<tr><td>BDIP30</td><td>Diploma Thesis</td><td>Z</td><td>30</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>BE3M35DRS</td><td>Dynamics and Control of Networks</td><td>Z,ZK</td><td>6</td></tr>
<tr><td colspan="4">This course responds to an ever-increasing demand for understanding contemporary networks large-scale complex systems composed of many components and subsystems interconnected into a single distributed entity. Herein, we will consider fundamental similarities between diverse areas such as e.g. forecasting the spread of global pandemics, public opinion dynamics and manipulation of communities through social media, formation controls for unmanned vehicles, energy generation and distribution in power grids, etc. Understanding such compelling issues goes far beyond the boundaries of any single physical, technological or scientific domain. Therefore, we will analyze phenomena across different domains, involving societal, economic and biological networks. For such networked systems, the resulting behavior depends not only on the characteristics of their individual components and details of their physical or logical interactions, but also on a precise way those components are interconnected the detailed interconnection topology. For that reason, the first part of the course introduces fundamental theoretical and abstract computational network analysis concepts; in particular, the algebraic graph theory, network measures and metrics and fundamental network algorithms. The second part of the course subsequently views networks as dynamical systems, studies their properties and ways in which these are controlled, using mainly methods of automatic control theory.</td></tr>
<tr><td>BE3M35ELS</td><td>Electronics in Space</td><td>Z,ZK</td><td>8</td></tr>
<tr><td>BE3M35ISRT</td><td>Introduction to Spectroscopy and Radiative Transfer</td><td>Z,ZK</td><td>8</td></tr>
<tr><td>BE3M35LSY1</td><td>Linear Systems</td><td>Z,ZK</td><td>6</td></tr>
<tr><td colspan="4">The purpose of this course is to introduce mathematical tools for the description, analysis, and partly also synthesis, of dynamical systems. The focus will be on linear time-invariant multi-input multi-output systems and their properties such as stability, controllability, observability and state realization. State feedback, state estimation, and the design of stabilizing controllers will be explained in detail. Partially covered will be also time-varying and nonlinear systems. Some of the tools introduced in this course are readily applicable to engineering problems such as the analysis of controllability and observability in the design of flexible space structures, the design of state feedback in aircraft control, and the estimation of state variables. The main motivation, however, is to pave the way for the advanced courses of the study program. The prerequsites for this course include undergraduate level linear algebra, differential equations, and Laplace and z transforms.</td></tr>
<tr><td>BE3M35OCS</td><td>Onboard Computer and Onboard Software</td><td>Z,ZK</td><td>7</td></tr>
<tr><td>BE3M35ORR</td><td>Optimal and Robust Control</td><td>Z,ZK</td><td>6</td></tr>
<tr><td colspan="4">This advanced course will be focused on design methods for optimal and robust control. Major emphasis will be put on practical computational skills and realistically complex problem assignments.</td></tr>
<tr><td>BE3M35PAT</td><td>Polar Atmosphere</td><td>Z,ZK</td><td>8</td></tr>
<tr><td>BE3M35PSA</td><td>Propulsion with Space Applications</td><td>Z,ZK</td><td>7</td></tr>
<tr><td>BE3M35SEI</td><td>Spacecraft Environment Interactions</td><td>Z,ZK</td><td>7</td></tr>
<tr><td>BE3M35SEP</td><td>Space Engineering Project 1</td><td>Z</td><td>7</td></tr>
<tr><td>BE3M35SIS</td><td>Swedish for International Students 1</td><td>Z,ZK</td><td>3</td></tr>
<tr><td>BE3M35SPC</td><td>Space Communication</td><td>Z,ZK</td><td>8</td></tr>
<tr><td>BE3M35SPI</td><td>Space Instruments</td><td>Z,ZK</td><td>8</td></tr>
<tr><td>BE3M35SPP</td><td>Space Physics</td><td>Z,ZK</td><td>7</td></tr>
<tr><td>BE3M35SRL</td><td>Flight Control Systems</td><td>Z,ZK</td><td>6</td></tr>
<tr><td colspan="4">The course is devoted to classical and modern control design techniques for autopilots and flight control systems. Particular levels are discussed, starting with the dampers attitude angle stabilizers, to guidance and navigation systems. Next to the design itself, important aspects of aircraft modelling, both as a rigid body and considering flexibility of the structure, are discussed</td></tr>
<tr><td>BE3M35SSD</td><td>Spacecraft System</td><td>Z,ZK</td><td>8</td></tr>
<tr><td>BE3M35TSS</td><td>The Solar System</td><td>Z,ZK</td><td>7</td></tr>
<tr><td>BE3MPROJ6</td><td>Project</td><td>Z</td><td>6</td></tr>
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For updated information see http://bilakniha.cvut.cz/en/f3.html
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