

## Lecturers

**Name:** Ing. Petr Skála

**Background:** Electrical engineering, robotic control

**Specialization:** Ph.D student, radioelectronics and image processing

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**CV:** [hyperlink](#)

**Name:** Doc. René Hudec

**Background:** Space science and engineering

**Specialization:** Associate Professor

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**CV:** <http://mmtg.fel.cvut.cz/personal/hudec/>

**Name:** Ing. Martin Urban, Ph.D.

**Background:** Microelectronics, Radioelectronics

**Specialization:** Research fellow, Robotic telescopes and X-Ray optics

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**Name:** Ing. Ondřej Nentvich

**Background:** Signal processing, microcontroller design

**Specialization:** Ph.D. student, satellite design

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# Course Description

**Title:** Czech in and Space out!

**Fields of activity:** Aerospace/Aeronautical Engineering , Applied Sciences , Computational Sciences , Control Engineering/Systems engineering , Electronic/Electrotechnical Engineering , Machine & Instrument engineering/Design , Materials Engineering , Mechanical Engineering , Physics/Physics Engineering , Power Engineering , Transport Engineering

**Examination type:** Project or Practical Work

**Number of ECTS credits issued:** 1

**Learning Goals and Objective:** The goal is gain basic knowledge about cosmic engineering and technologies used in cosmic devices and systems.

# Syllabus

Name of activity	Introduction to space engineering
Number of working hours	2
Type of activity	Lecture
Lecturer	Doc. Hudec
Short summary of content	Lecture by Doc. Hudec, guarantor of the Space Engineering course at the Faculty of Electrical Engineering. Introduction to basic physics, instruments and technologies used for planning and executing space missions. Vacuum, magnetosphere, ionosphere, micrometeorite impacts and debris. Basics of cosmology.
Bibliography	N/A
Expected effect	Students will gain basic insight about the vacuum environment.

Name of activity	Space radiation and measurement - part 1
Number of working hours	3
Type of activity	Lecture
Lecturer	Ing. Skála, Ing. Urban
Short summary of content	Introduction to radiation and ionization in space. Design of spacecraft shielding and outer casing. Van Allen belts. Thermal management of spacecrafts.
Bibliography	N/A
Expected effect	Students will understand problematics of radiation and plasma in vacuum.

Name of activity	Space radiation and measurement - part 2
Number of working hours	3
Type of activity	Laboratory
Lecturer	Ing. Skála, Ing. Urban
Short summary of content	Radiation detection, designing of a simple detector using circuit board. Measurement in laboratory conditions and processing the measurement using CAD software.
Bibliography	N/A
Expected effect	Students get to apply their insights about radiation from last lecture during laboratory work, which will hopefully settle the knowledge.

Name of activity	Observatory visit
Number of working hours	4
Type of activity	Company visit
Lecturer	Ing. Skála
Short summary of content	Visit to the Štefánik observatory, located at the Petřín hill. Commented excursion by local staff followed by hands-on observation of sunspots.
Bibliography	N/A
Expected effect	Students gain knowledge about history of stargazing and observations in Czechia from professionals.

Name of activity	Space orbit - part 1
Number of working hours	4
Type of activity	Tutorial
Lecturer	Ing. Skála, Ing. Nentvich
Short summary of content	Introduction to orbital mechanics, mathematical modelling of dynamic systems and simulation.
Bibliography	An introduction to celestial mechanics
Expected effect	Students will understand the inner workings of space satellites.

Name of activity	Space orbit - part 2
Number of working hours	4
Type of activity	Workshop
Lecturer	Ing. Skála, Ing. Nentvich
Short summary of content	Planning of space mission, programming a simple cubesat microcontroller.
Bibliography	N/A
Expected effect	Students will implement their code on a simulated device and compare the results.

Name of activity	Robotic telescope
Number of working hours	3
Type of activity	Group seminar
Lecturer	Ing. Urban
Short summary of content	Robotic telescope operation and measurement, processing the measured data using software. Identification of celestial phenomena from images. RTG lobster-eye optics.
Bibliography	N/A
Expected effect	Students will learn in teams how different light spectra are measured and processed.

Name of activity	Rocket science
Number of working hours	3
Type of activity	Project work
Lecturer	Ing. Urban
Short summary of content	We build some rockets. Design of a rocket body using CAD software and printing it on a 3D printer.
Bibliography	N/A
Expected effect	Students will learn how to design an aeronautically feasible rocket design.

Name of activity	Rocket launching
Number of working hours	2
Type of activity	Field work
Lecturer	Ing. Skála
Short summary of content	We fire some rockets.
Bibliography	N/A
Expected effect	Students will get to experience controlled hobby rocket launch under guidance of a professional.

Name of activity	Examination
Number of working hours	1
Type of activity	Examination
Lecturer	Everyone
Short summary of content	Rocket presentation in teams.
Bibliography	N/A
Expected effect	Students will present their final work before launching it.

# Pre-materials

Even though no prior knowledge of cosmic engineering is required, it is highly recommended to go through the links listed below.

**For links:**

<b>Name</b>	<a href="#">MATLAB and Simulink Training</a>
<b>Topic/field</b>	Introduction to MATLAB programming
<b>Short description</b>	Learning platform for the essentials of MATLAB® through free, two-hour introductory tutorial on commonly used features and workflows.

<b>Name</b>	<a href="#">C Language</a>
<b>Topic/field</b>	C programming language
<b>Short description</b>	Introduction to C programming language basics divided to many categories. Suitable materials for beginners with practical examples.

**For books/articles:**

<b>Name</b>	<a href="#">An introduction to celestial mechanics</a>
<b>Topic/field</b>	Orbital mechanics
<b>Professor/Author</b>	Forest Ray Moulton, Ph.D.
<b>Short description</b>	An unrivaled text in the field of celestial mechanics, Moulton's theoretical work on the prediction and interpretation of celestial phenomena has not been superseded. By providing a general account of all parts of celestial mechanics without an over-full treatment of any single aspect, by stating all the problems in advance, and, where the transformations are long, giving an outline of the steps which must be made, and by noting all the places where assumptions have been introduced or unjustified methods employed, Moulton has insured that his work will be valuable to all who are interested in the subject.