SYLLABUS

Electronics in Space 7.5 credits E7001R

Rymdelektronik

Course syllabus admitted: Spring 2024 Sp 3 - Present

DECISION DATE
2023-02-15

Luleå University of Technology 971 87 Luleå, Sweden
Phone: +46 (0)920 49 10 00 • Corporate Identity: 202100-2841

LULEÅ TEKNISKA UNIVERSITET

Electronics in Space 7.5 credits E7001R

Rymdelektronik

Second cycle, E7001R

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Rymdteknik	Space Technology

Main field of study

Space Technology

Entry requirements

Electronics (E0007E), or similar qualifications.

Good knowledge in English equivalent to English 6.

Selection

The selection is based on 30-285 credits

Course Aim

The aim of the course is to extend the students knowledge of electronic devices and circuits and the effects of space upon them to that required for space applications. On completion of the course the student shall have the skills and knowledge to be able to:

1. Determine the requirements and specification of electronic circuits required for a number of space instruments;
2. Analyse, design and measure the characteristics and limitations of circuits used to meet the demands of space instrumentation;
3. Describe the construction and operation of semiconductor devices and the effects that space radiation has on their characteristics and to design circuits to protect them;
4. Describe the reasons for and uses of screening, grounding and circuit layout and design, in meeting electromagnetic compatibility requirements in a space system;
5. Cooperate with other students in undertaking practical design and reverse engineering projects and writing technical reports in English.

Contents

The course will cover:

1. The electronic circuit requirements of a number of space instruments;
2. Examples of circuits such as differential amplifiers for very high common mode voltages, charge and pulse shaping amplifiers, flash A/D converters, current to voltage amplifiers, bootstrapping and guards, high voltage and switch mode amplifiers;
3. The construction, operation and characteristics of semiconductor devices such as bipolar and field effect transistors, CMOS devices, CCD and CMOS arrays and the use of silicon on insulator technology;
4. The effect of space radiation on semiconductor materials and devices and the resulting change in characteristics and damage including single event upsets, total dose effects and component failure;
5. The necessity for suitable screening, grounding and electromagnetic compatibility in a space system.

Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.
The course consists of lectures and demonstrations in the laboratories; practical exercises and design projects including a reverse engineering one.
Parts of the teaching may be implemented using hybrid/blended education methods (online, videos, etc).

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.
To pass the course the student must have their lab reports and assignments approved, and pass the written exam.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term “unauthorized aids” refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Remarks

It should be noted that approximately three quarters of the content of this course is the same as that of course E7003R. Because of this overlap no student may include both this course and course E7003R in their degree.

This course gives the foundation for the demands that must be put on construction of a spacecraft in order for it to work in space. Thus it gives a ground for the course R7029R Space System Engineering.

Overlap

The course E7001R is equal to RYM008

Course offered by

Department of Computer Science, Electrical and Space Engineering

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0002	Laboratory work	U G#	3	Mandatory	A07	
0004	Written exam	G U 3 4 5	4.5	Mandatory	S22	

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Robert Brännström 2023-02-15

Syllabus established

The course plan was accepted by the Dept of Space Science 2007-02-28 and remains valid as from H07.