UiT
NORGES
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.

PROGRAMME DESCRIPTION

Aerospace Control Engineering - Master

120 credits

Narvik

Based on National Curriculum Regulations for Engineering Education of 03.02.2011 and 01.08.2018

The programme description has been approved by the board of Faculty of Science and Technology on 01.12.2017

Study programme name	Bokmål: Aerospace reguleringsteknikk Nynorsk: Aerospace reguleringsteknikk Engelsk: Aerospace Control Engineering - Master
Degree obtained	Master of Science
Target group	The master program in Aerospace Control Engineering is applicable for students with interest in learning, developing, and applying state-of-the-art control technology for aerospace-related purposes. The type of technology has also large similarities with technologies for extreme environments, such as in arctic regions and subsea, and students with interest in development of technologies in such fields will also find this program as relevant.
Admission requirements, required prerequisite, recommended prerequisite knowledge	To be applicable for the master program in Aerospace Control Engineering, you must have a relevant undergraduate bachelor in engineering with minimum 30 credits mathematics/statistics topics. You should also have primarily knowledge within electronics, aerospace engineering or control engineering, but it may also be within related fields such as space and aerospace technology, power electronics or computer science.
Certificate of good conduct	N/A
Suitability assessment	N/A
The study programme's Learning Outcome	**Knowledge:** • has advanced knowledge within the academic field of mathematics, physics and engineering and specialized insight in a limited area within the field of aerospace engineering • has thorough knowledge of different theories and methods in the field of control engineering • can apply knowledge in electronics, automatic control and systems engineering to areas within aerospace engineering • can analyze academic problems within aerospace control engineering on the basis of the history, traditions, distinctive character and place in society of the academic field **Skills:** • can analyze and deal critically with various sources of information and use them to structure and formulate scholarly arguments • can analyze existing theories, and interpretations in the field of satellite engineering and work independently on practical and theoretical problems • can use relevant methods for research and scholarly work in an independent manner

	• can carry out an independent, limited research or development project under supervision and in accordance with applicable norms for research ethics • can develop the cooperation skills to work in inter-disciplinary projects and to work in team **General competence:** • can analyze relevant academic, professional and research ethical problems • can apply the knowledge and skills within aerospace control engineering in new areas in order to carry out advanced assignments and projects • can communicate extensive independent work and masters language and terminology of the academic field of aerospace engineering • can communicate about academic issues, analyses and conclusions in the field of aerospace control engineering, both with specialists and the general public • can contribute to new thinking and innovation processes
Academic content and description of the study programme	The master program in Aerospace Control Engineering at IVT-faculty, UiT Narvik Campus provides a unique education in Norway, where you as a student will learn about the most relevant technologies necessary for design, construction, and utilization of control systems in aerospace applications. Through the two-year program, important theoretical preliminaries such as applied mathematics, digital system and signal theory, embedded systems, navigation and automatic control are covered, as well as more specialized topics on system identification, artificial intelligence, and modeling, guidance and control. Through a multidisciplinary program, students learn the relevant methods and skills in various technological fields, with a commonality through its application in aerospace-related systems. The program involves lectured courses, as well as a high degree of problem-based education (i.e. learning by doing), where the students spend their time working on relevant projects under supervision of a highly qualified staff. The project topics are chosen from ongoing internal research projects, as well as national and international aerospace related projects that UiT participates in. Therefore, several projects has ended in results at a high international level, published in international scientific journals. The students have also been able to present their results for international audiences at scientific conferences and workshops. In the last few years, such projects have included: • Attitude determination and control system design for the European Student Earth Orbiter (ESEO) and European

	Student Moon Orbiter (ESMO) spacecraft under the SSETI-project initiated by the European Space Agency (ESA). • Development of an Aerosol detector rocket payload for collection of ionized dust particles, under the ESPRIT project by NASA. • Design, implementation and testing of all subsystems (ground station, power supply, data handling, control, communication and payload) in UiTs own spacecraft HiNCube. • Mathematical modelling, synchronization and coordinated control of small spacecraft in formation, in cooperation with internal PhD-students and supervisors. • Mathematical modelling, guidance and control of unmanned aerial vehicles (UAVs), in cooperation with internal PhD-students and supervisors. To provide a high-quality education with relevance to industry, UiT is cooperating with the national universities in Oslo (UiO), Bergen (UiB), Trondheim (NTNU), as well as European Space Agency, Norwegian Space Centre and the Norwegian Centre for Space-related Education (NAROM). The program covers the following disciplines: - Linear Algebra and Numerical Methods - Classical Mechanics - Control Engineering - Instrumentation and Measurement - Discrete-Time Signal Processing - Knowledge-based Systems (AI) - System Identification - Mathematical Modeling and Simulation - Spacecraft System Engineering - Embedded systems - Master thesis See additional information in the different course descriptions. The program is uniform and does not include different modules or electives, and all teaching is on campus. Mandatory tasks are described in the different course descriptions. The program can be done part-time over four years. It will be possible to take part of the studies abroad, provided that external courses are similar in content and scope to those specified in the study plan.
Table: programme structure	See Table 1 at the bottom of this document

Learning activites, examination and assessement	Learning activities is completed differently dependant on the subject. The traditional lecture model is commonly used, in addition, some instances occur where variants of flipped classroom is used. In a traditional lecture model, the teacher gives lectures at scheduled hours. A portion of the scheduled lectures will, however, be reserved for other learning activities such as problem solving, completing mandatory work, project work or laboratory work. The person with course responsibility or teaching assistants will be present to provide guidance at these events. The students learn through preparation and working on the lectured theory, completing mandatory coursework requirements, doing problem solving, project work together in groups, laboratory work, self-evaluating and a fair amount of self-study. When utilizing flipped classroom the lectures is moved out of the classroom and is done as part of the preparation by the student and thus the student itself has the responsibility of completing the lectures. The preparation part usually consist of students watching pre-recorded videos, in addition to studying recommended parts of the reading list, notes and recommended relevant materials. The scheduled hours at the university is then used for reviewing a specific subject matter, and mainly for problem solving. The flipped classroom model can also be used in a “hybrid”-model where parts of the subject is done using the traditional lecture model and other parts is completed using the flipped classroom model. The students learn through the same mechanisms as mentioned for the traditional lecture model above, however the students have a larger responsibility them self to acquire the knowledge necessary for problem solving. It is important that the student knows the difference between problem solving, coursework requirements, and evaluation. Coursework requirements is mandatory requirements that’s has been precisely formulated in the course description. In order for the student to be assessed, the course requirements must be approved. Task given in problem solving sessions are task that not necessarily will be marked; these are given to the students for practice and/or preparation for bigger task such as coursework requirements. It shall be made clear when a task is presented whether or not it is voluntary or part of the coursework requirements.

	Mandatory coursework requirements may for instance be formulated as “X of Y mandatory tasks must be approved” “the student must be present 70% of the scheduled hours” The person with course responsibility makes a list of students with approved coursework requirements to the exams office. Only those with approved coursework will be assessed. The manner of which the students are assessed is described precisely in the course description of individual courses. This may for instance be • Written exam (pen and paper) • Oral exam • Combined of several works, which may include a written exam • Group exam • Portfolio assessment The opportunity for completing a re-sit exam(re-assessment) in a course may vary between courses. Details may be found in the specific course description. Attending the learning activities in the various courses provides the students knowledge on scientific theory and experience using the scientific method. Subject matter in the specific courses is based on relevant and in some cases state-of-the-art research.
The study programme’s relevance	Successfully qualified candidates can acquire jobs in a range of Norwegian businesses, which contribute technical products and services within aerospace technology, but also within fields as subsea engineering, systems engineering, or robotics and automation. The program also provides a basis for working with project management and marketing, or teaching in technical subjects at Bachelor's level. The degree qualifies to start as a PhD-student within relevant ph.d.-areas (i.e. engineering cybernetics, applied mathematics, control engineering, engineering science). UIT Campus Narvik has a ph.d. education within the field of Engineering science, which students from Aerospace Control Engineering are qualified to get a position at, if the grades are sufficient (for instance for acceptance as a doctoral student), and if there are available positions.

	The academic content, learning activities and assessments presented in this study plan ensure relevance to the current state-of-the-art in the field of Aerospace Control Engineering.
Work scope	The students shall expect to work 45 hour pr. week with their studies, including lectures, seminars and self-studies.
For master’s theses/independent work in master’s degrees	The final master thesis (diploma) can be carried out in close collaboration with industry partners and/or on the basis of existing research and development projects. The work is usually performed individually. Regular status meetings will be held through the entire project period. The diploma will be evaluated solely based on a final written report.
Language of instruction and examination	English
Internationalisation	A master in Aerospace Control Engineering has an international perspective, as the aerospace field itself is indeed very international. The students get an international perspective through English language curriculum, international lecturers and different learning activities.
Student exchange	The Faculty of Engineering Science and Technology facilitates student exchange for interested students so that it is possible to study parts of the master’s program at other universities. An individual plan must then be drawn up in consultation with the study coordinator.
Supervised professional training	
Administrative responsibility and academic responsibility	Faculty of Engineering Science and Technology, Department of Electrical Engineering
Quality assurance	The study plan is subject to revision and quality assurance in accordance with the quality assurance program at IVT with regards to the conditions on use of the protected tittle Sivilingeniør (Siv. Ing.) acknowledged by NRT.
Other regulations	

Table 1, program structure

<table>
<tr><td>Term</td><td colspan="2">10 Ects</td><td colspan="2">10 Ects</td><td colspan="2">10 Ects</td></tr>
<tr><td>First semester (Autumn)</td><td>STE3501 Classical Mechanics</td><td>SMN6195 Complex Analysis</td><td colspan="2">ELE3501 Control Engineering</td><td>SMN6191 Numerical Methods</td><td>SMN6190 Linear algebra 2</td></tr>
<tr><td>Second semester (Spring)</td><td colspan="2">STE6296 Systems Engineering</td><td>STE6246-001 Knowledge-based systems</td><td>STE6304 Mathematical modeling and simulation</td><td>STE6219 Discrete-time signal processing</td><td>SAD6210 Innovation and economics</td></tr>
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Third semester (Autumn)	SHO6300 Master thesis M-ST	STE3500 System Identification	STE6302 Embedded systems	STE6251 Spacecraft control	SAD6211 Innovation and management
Fourth semester (Spring)	SHO6300 Master thesis M-ST				