Aircraft Systems Engineering

Programme course

6 credits

Flygplanssystem

TMAL56

Valid from: 2018 Spring semester

Determined by
Board of Studies for Mechanical Engineering and Design

Date determined

Main field of study
Aeronautical Engineering, Mechanical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Aeronautical Engineering, Master's Programme
- Mechanical Engineering, M Sc in Engineering

Entry requirements
Aircraft and Vehicle Design, Aerodynamics, Flight Mechanics, Engineering System Design

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Aircraft and Vehicle Design, Aerodynamics, Flight Mechanics, Engineering System Design

Intended learning outcomes
The course aims to give students a basic understanding of aeronautics from a system perspective, so that a good overall holistic view is obtained, and that a sound engineering approach to engineering is developed. After the course, the student should be able to:

- Understand the interaction between the different subsystems to achieve the desired functionality.
- Use simulation tools to analyze and optimize system performance, at the aircraft level.
- Understand the function of the basic aircraft systems.
- Implement control, communication and measurement systems for the small flying vehicles.

Course content

- Systems Engineering
- Systems architecture of aircraft on-board systems
- Certification
- Flight control system
- Actuator system technology for flight control: hydraulic, electro-hydraulic (EHA) and electro-mechanic (EMA) actuators
- Bleed air systems
- Fuel system
- Electrical power system, radar, radar cross section (RCS), etc.
- Modelling and simulation for system analysis.
- System optimization
- System reliability analysis / fault tree analysis
- Systems architecture for small unmanned vehicles (e.g. MAV).
- MAV, Sensors, servos, communication, onboard-computers.

A large part of the methodology of the course focuses on the holistic system where the subsystems studied in relation to the impact on airplane characteristics.

Teaching and working methods

Lectures and group exercises.
The course runs over the entire spring semester.

Examination

UPG1	Assignments	1 credits	U, G
TEN1	Written examination	5 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Course literature

Scientific Papers

Department

Institutionen för ekonomisk och industriell utveckling

Director of Studies or equivalent

Mikael Axin

Examiner

Ingo Staack

Education components

Preliminary scheduled hours: 40 h
Recommended self-study hours: 120 h

Course literature

Articles

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.

Degree project for Master's Degree in Engineering 300 credits, Master of Science (Two years), Master of Philosophy (Two years), Master of Science (One year), and master's degrees without prefix

General provisions for the degree project are given here. A specific board of studies may have supplementary regulations that are specific for a study programme. These are specified, where relevant, in the syllabus for the field of education and/or the degree project. Information and links to course syllabuses, registration, reflection documents, etc. can be found at www.lith.liu.se/examensarbete/examensarbete?l=sv.

General provisions

To be awarded a Master's Degree in Engineering 300 credits, Master of Science (Two years), Master of Philosophy (Two years), Master of Science (One year), or master's degree without prefix a student must carry out an approved degree project. The components of the degree project are described in the relevant course syllabus.

Aim

The aim of the degree project is described in the relevant course syllabus, www.lith.liu.se/examensarbete/examensarbete?l=sv. Links to respective course syllabus can be found under the heading "Utbildningarna" (Civilingenjörsutbildning (i.e. Master of Science in Engineering) or Masterutbildning (i.e. Master of Science)).

Extent

Requirements for the extent of the degree project for each type of degree are given in the syllabus of the study programme.

Locations for a degree project

The work is carried out in the form of:

- an internal degree project located at one of the participating departments at LiU
- an external degree project located at a company, government agency, or other organisation in Sweden or abroad, that an examiner has assessed is able to manage a degree project that satisfies the requirements, or
- a degree project within an exchange agreement in association with study abroad, whereby all study results are to be credited to the student by the relevant board of studies.

The main subject areas that are permitted within each study programme are described in the programme syllabus. Any individual subjects that may be relevant to the main subject area are to be determined by the relevant board of studies.

The examiner for a degree project within a certain subject area are determined by the board of studies that is responsible for general degrees within the main subject area. An up-to-date list is given
at http://www.lith.liu.se/examensarbete/examensarbete?l=sv.

Degree projects within agreements relating to study abroad

During study abroad that takes place within the framework of an agreement, the provisions of the host institute relating to degree projects are applied. The student is to consult the board of studies and together ensure that the proposed degree project is carried out in a main subject area that is permitted within the study programme. Approved main subject areas for degree projects are specified in the syllabus for the relevant programme.

A certificate confirming that the degree project has been approved and a copy of the degree project thesis (in PDF format) are to be submitted to the relevant board of studies.

Selection of degree project

A degree project is to be selected in consultation with an examiner, who is also responsible that the specialisation, extent and level of the project satisfy the requirements specified in the course syllabus.

In cases in which issues relating to work-related copyright, patenting or remuneration may arise, provisions governing these should be established in advance. A student working on a degree project may sign a confidentiality agreement in order to obtain access to confidential information necessary for the degree project. The supervisor and examiner, however, determine whether they are prepared to sign a confidentiality agreement, and thus the confidential information must not normally be of such nature that it is necessary to supervise or grade the work. The complete degree project thesis is to be published during the grading procedure, unless special circumstances prevent this. If any part of the thesis should not be published, this must be approved in advance by the examiner and the relevant head of department. Note that final decisions relating to confidentiality are taken by an administrative court.

Commencement of a degree project

Requirements that must be satisfied before a degree project can be started are given in the currently valid course syllabus, which can be obtained at www.lith.liu.se/examensarbete/examensarbete?l=sv.

Notification of a degree project is to be carried out when the degree project starts, at www.lith.liu.se/for-studenter/anmalan-till-exjobb?l=sv. Registration of the degree project is to take place before work commences, after the student has registered for the term.

Before the start of the degree project, the examiner is to ensure that the student satisfies the conditions for commencement of the degree project within the relevant main subject area. Support in this can be obtained from the study guidance counsellor, who checks the general requirements for starting the degree project.

The student is also to notify the relevant department of the start of the degree project.

Degree projects in collaboration with another student

In cases in which two students carry out a degree project together, the contribution of each student is to be specified. The extent of the work is to correspond to the extent of two individual projects. The examiner is to ensure that each student has contributed in a satisfactory manner to the work, and that each student satisfies the requirements for achieving a Pass grade for the degree project.

Degree projects carried out in collaboration between more than two students are not permitted.

Examiners

The examiner is to be employed at LiU as professor, associate professor, senior lecturer, research fellow, lecturer, research assistant, or postdoc (including guest and adjunct teachers), or is to have been appointed docent at LiU. He or she must have the expertise required to examine the degree project within the relevant main subject area, and must be appointed by the board of studies. The examiner is to:

- ensure before the start of the degree project that the student satisfies the conditions for commencement of the degree project within the relevant main subject area. The study guidance counsellor is to check whether the commencement criteria are satisfied and inform the examiner of this
- check whether special admission requirements (where relevant) are satisfied, for example that the student can demonstrate a certain degree of in-depth knowledge within the field relevant for the degree project
- determine the specialisation and principal work of the degree project, based on an assessment of whether the degree project will result in the learning outcomes of the course syllabus being satisfied
- pass/fail the planning report

- pass/fail the mid-way assessment
- be responsible that the supervisor or supervisors carry out their duties
- before the presentation, check that the student has registered for the degree project
- approve the work for presentation
- before the presentation, check that the proposed opponent satisfies the conditions for commencement of the degree project and has attended three thesis presentations
- pass/fail the presentation and the opposition to it
- approve a concluding reflection document
- ensure that a degree project that has been passed satisfies the learning outcomes of the course syllabus and other requirements, and award a grade to the degree project (either G = Pass, or U = Fail).

Supervisors

A student working on a degree project is to have access to an internal supervisor at the department at which the degree project has been registered. The internal supervisor is to have a degree that corresponds at least to the level of the degree project to be supervised. The internal supervisor may, in exceptional circumstances, be the same individual as the examiner. A decision of whether to allow this in a particular case is to be made by the relevant board of studies before the degree project is started.

The supervisor is to ensure that the student obtains help with:

- expert support in general questions related to methods, specialist knowledge of the subject, and writing the thesis
- problem formulation, and setting the limits of the work
- scheduling and planning work, and selection of appropriate methods.

If the degree project is being carried out outside of LiTH, an external supervisor from the commissioner is to be appointed.

Planning report

During the first weeks of the degree project, the student is to draw up a planning report that contains:

- a preliminary title of the degree project
- a preliminary statement of the research question, against the background of a literature search
- a preliminary description of the approach to be taken
- planned literature foundation
- a schedule for the execution of the degree project, including suggested dates for the mid-way assessment and presentation.

Formulation of the research question is to be bounded, realistic and viewed from a perspective of societal or commercial benefit. The term “societal” is to be understood here to include universities and university colleges.

Mid-way assessment

Approximately half-way through the degree project, the student is to describe to the examiner at a mid-way assessment how the work is progressing relative to the planning report. The supervisor should also participate. The form of the mid-way assessment may be anything from an oral presentation to a public seminar. The conclusion of the mid-way assessment may be one of three possibilities:

1. The work has been carried out essentially as planned, and can continue as planned. The mid-way assessment has been passed.
2. The work has been carried out with certain deviations from the planning report. It is, however, believed that it will be possible to complete the work with minor adjustments to the formulation of the research question, approach and/or schedule. The mid-way assessment has been passed.
3. The work has deviated from the planning report in a significant manner, and there is a risk that a Pass grade cannot be given. The mid-way assessment has been failed. A new planning report must be drawn up and a new mid-way assessment carried out.

Reporting

Both oral and written reports of the degree project are to be made, in Swedish or English. For the international Master's programmes, both the oral and written examination should be made in English. The board of studies can allow the reporting to be carried out in another language than Swedish or English.

The oral presentation is to take place in public, unless there are special grounds that this should not be done. The written report is to be in the form of a professionally produced degree project thesis. The presentation and thesis are to follow the instructions given below.

Presentation

The oral presentation is to take place when the examiner considers that the work has been completed and is ready to be presented. The presentation is to take place at LiTH at a time when other students can attend. This means that the presentation can take place on a date that the student has agreed with the examiner, normally between the re-examination period in August and midsummer, and after the student has attended three thesis presentations.

The oral presentation is to describe the background to the problem that has been studied, describe the methods used, and present the results and conclusions. The presentation is to be at a level suitable for everyone present, not just for specialists. After the oral presentation, the student is to counter any criticism that the opponent may raise, and allow other participants to pose questions. The presentation and the opposition are to be approved by the examiner. When any required adjustments of the thesis have been made, the reflection document has been approved, and the student has functioned as an opponent for another degree project, the degree project is reported as a passed course and the credits can be used to satisfy the requirements for a qualification.

Degree project thesis

The written degree project report is to be professionally written and comprehensive, and it is to demonstrate a scientific approach. The report must be prepared in accordance with principles for acceptable practice when referring to sources (references or quotations for which the source is specified) when the text, images, ideas, data, etc., of other people are used. It is also to be made clear whether the author has reused his or her own text, images, ideas, data, etc. from previous examinations, such as undergraduate work, project reports, etc. (This is sometimes known as "self-plagiarism".) A failure to specify such sources may be regarded as attempted deception during examination.

The contents are to be easy to understand, and the way in which material is presented is important. It must describe the background to the project and the formulation of the research question. The choice of approach is to be clearly explained, and the thesis should make clear the coupling between the results and the conclusions. Commonly accepted scientific methods are to be used for processing the results. The discussion is to be comprehensive, and demonstrate that the student masters analytical thought processes. The thesis is to demonstrate good mastery of the literature in the field, and include an abstract. Theses that are principally written in Swedish should contain a summary in English. A publication-ready manuscript and a reflection document covering the work undertaken are to be submitted to the examiner within 10 days after the oral presentation. The examiner may grant an exemption from this requirement. If final versions of the required documents are not submitted as stipulated, the examiner may determine that the presentation is to be rescheduled.

The Faculty of Science and Engineering (Institute of Technology) at Linköping University recommends that degree project theses be published.

Opposition

An oral opposition is to be carried out either before or after the student presents his or her thesis. The opponent must satisfy the same requirements for the number and level of credits gained as those of the student's degree project. The opponent must also have attended three thesis presentations as a member of the audience. Acting as an opponent during the thesis presentation of another student is subject to points-based assessment as described in the course syllabus.

The opponent is to:

- discuss and comment on the selection of methods, results and (where relevant) data processing, conclusions, possible alternative solutions and conclusions, and the management of literature
- comment on the general arrangement of the degree project thesis and related, formal aspects of style, and comment on the oral presentation technique
- illuminate the strengths and weaknesses of the thesis.

The duration of the opposition should be approximately the same as that of the presentation, and it is to include a discussion in which the student presenting the thesis replies to and comments on the criticism raised by the opponent.

Unless otherwise agreed, at least one week before the presentation the opponent is to present in writing to the examiner the important issues that will be discussed, and the structure of the opposition that will be taken. The opponent and the examiner discuss the structure that the opponent has drawn up.

In a normal case, the number of opponents will be the same as the number of respondents. In exceptional cases, the examiner may decide that this is not to be the case.

Attendance at presentations

A student is to attend presentations of degree project theses as described in the course syllabus. The presentations attended must be at the same level or a higher level than the degree project of the student.

It is advantageous that one of the presentations attended is a licenciate degree seminar or a doctoral disputation. The student is responsible for ensuring that a certification of attendance at the presentation is obtained and passed to the departmental administrator for registration in Ladok. Attendance at such presentations is a component of the degree work that is subject to points-based assessment.

The occasions on which a student attends presentations are to be completed before the student presents the degree project thesis. The course syllabus for the degree project describes the scheduling of the attendance at presentations.

Reflection document

A document reflecting on the work that has been carried out is to be submitted to the examiner within 10 working days of the oral presentation. Instructions for preparing a reflection document can be reached through www.lith.liu.se/examensarbete/examensarbete?l=sv.

Grades

The degree project is graded as either Pass or Fail. In order for a student to obtain a pass grade for the degree project, all components must be completed and be awarded a pass grade.

Right to obtain supervision

It is expected that the student complete and pass a degree project within specified time limits. The department is required to provide supervision for a maximum of 18 months after the student has registered the degree project in Ladok. The examiner may grant additional supervision after this period in special cases. If the examiner determines that supervision is to be ended, the degree project is to be awarded a Fail grade.

If the degree project is awarded a Fail grade for the reason described above or for any other reason, the student is to be directed towards carrying out a further degree project.

Quality assurance

The relevant board of studies has overall responsibility for the quality of study programmes. This responsibility covers also degree projects. Quality assurance is to be carried out as determined by the faculty board.

Exemptions

If special circumstances apply, a board of studies may grant exemptions from the regulations specified above. The oral opposition, for example, may be replaced by an extensive written opposition, if the board of studies approves this

- for international students for whom special circumstances apply
- for other students for whom all other components of the qualification have been satisfied, the degree project thesis has been submitted, and special circumstances apply.

Written opposition may be carried out in one of the following ways:

- The student presents a written opposition to a degree project thesis that has been written by another student, whose examiner subsequently examines the opposition.
- The student's examiner requests that the student prepare a written opposition to a degree project thesis that has previously been examined by an examiner.

If written opposition is used, it is not necessary that the student prepare an introductory statement describing the structure.

The board of studies must approve that opposition may take place in written form, before it is carried out.