Course description TME047 – Chalmers Formula Student

Content

This is a design-build-test course where you will build a complete ground vehicle in the form of a small competition car together with other students in a team. Each team member contributes with a subsystem on the car or by performing functions in the project. The finished vehicle must fulfil the current competition rules for Formula Student Germany (FSG) and competition specific rules.

Aim

The aim of this course is that you should gain hands-on knowledge and experience from a large engineering project. The course concerns a total car concept where the entire process from conception and design to implementation and operation is covered. In addition to the technical aspects, system-based thinking, communication and teamwork are important.

Learning outcomes

Learning outcomes (after completion of this course, the student should be able to):

- Apply functional and solution models in the concept phase of an engineering project to analyse and create concepts for vehicle parts and systems.
- Apply Computer Aided Engineering (CAD and simulation tools) to design and analyse vehicle parts and systems.
- Produce drawings or other basis for manufacturing that can be understood by a third party.
- Lead structured meetings. The requirements for a structured meeting are that there is an objective and agenda for the meeting and that notes are taken where conclusions and actions from the meeting are recorded.
- Create a project planning that includes tasks and deliverables with due dates and responsibles.
- Derive engineering requirements for a technical system or part using a goal hierarchy method.
- Show understanding for how an individual part or subsystem contributes to the system as a whole, and that the added value to the system (and its cost efficiency) can vary greatly between different part or subsystem options.
- Manufacture or assemble parts within one of the manufacturing areas metals, plastics (e.g. carbon fibre reinforced plastics) or electronics.
- Perform physical tests of a vehicle or vehicle subsystem and evaluate their performance against design targets.
- Analyse and explain discrepancies in theoretical and measured performance for a component or system.
- Communicate work status and issues to team members throughout the project
- The student should demonstrate understanding for the concept of diminishing returns

Literature

- The CFS Handbook by Magnus Urquhart. Available at Store in the Student Union Building.
- Presentation slides from lectures
- Descriptions of tasks and methods for each project phase will be made available once the course has started.

- Current Formula Student Germany Rules and competition specific rules.

Course personnel

	Name	Telephone	Email
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Examination

Written reports, oral presentations and peer review. To be approved in the course active participation in the project, work of sufficient quality and satisfactory presentation of results are required. Active participation also includes attendance at the compulsory occasions for the course. TME047 consists of two parts of 3 and 12 credits where the first three credits cover study periods 1 and 2 while the 12 credits cover study periods 3 and 4. The final grade will not be given until study period 1 of the following year. For the first part the grading is Passed/Not passed and for the second part and the final grade the scale is: Five, Four, Three and Not passed.

In order to pass part one you need to

- Participate actively in the project
- Be part in the submission of a pre-study report for your subgroup
- Submit the first peer review
- Attend mandatory activities for this part
- Demonstrate work of sufficient quality
- Submit two work-sample hand-ins in the form of a) an engineering specification b) a drawing or other basis for manufacturing
- Make an individual presentation of your design work

If you don’t pass part one you are not allowed to continue with part two.

In order to pass part two you need to

- Participate actively in the project
- Submit an individual design report
- Submit an individual final report
- Submit the second and third peer review
- Attend mandatory activities for this part
- Demonstrate work of sufficient quality

The grading for part two and the final grade of the course (which covers the whole course) will be decided from the following constituents

Project work 60% whereof

- Engineering* understanding/proficiency 20%
- Contribution 20%
- Team interaction, Responsibility & Commitment 20%

Final report 40% whereof

- Engineering* content 30%
- Report writing technicalities 10%

*For the students in the business and management group their area of work will be assessed instead of Engineering.

Hence, your final grade will then be based on 50% in technical examination, 40% in project and team work and 10% in formal report writing.
Grades are set according to the following process; The examiner will, based on the final report, presentations and project work set an individual grade. In this process input from supervisors and peer reviews will be considered

Summary of changes since the course was given last

The hand-ins for a) an engineering specification and b) a drawing or other basis for manufacturing have been added.

Organisation

The general organisation of the Chalmers Formula Student project consist of:

- Lectures
- Weekly team meetings
- Weekly subgroup meetings
- Project phase dependant team organisation with subgroups and roles with different areas of responsibility
- Written project reports (Pre-Study, Design, and Final)
- Oral Presentations (Pre-Study, Design, Manufacturing and Final)

In Figure 1 the general time line for the CFS project is shown. It can be seen that the project consists of 7 parts: Application, Concept, Design, Manufacturing, Testing, Competitions and Handover. The project phases Concept, Design, Manufacturing and Testing/Competition follows the CDIO (Conceive, Design, Implement and Operate) educational framework. The idea behind CDIO is to enhance learning by allowing students to get direct feedback on their own concept and design work through implementation and operation of their creations. It is important to recognise that the Formula Student competitions assess the final product during operation, and without sufficient testing of the vehicle before competitions the learning and feedback on the design systems will be smaller and the competition performance will most likely be lesser.

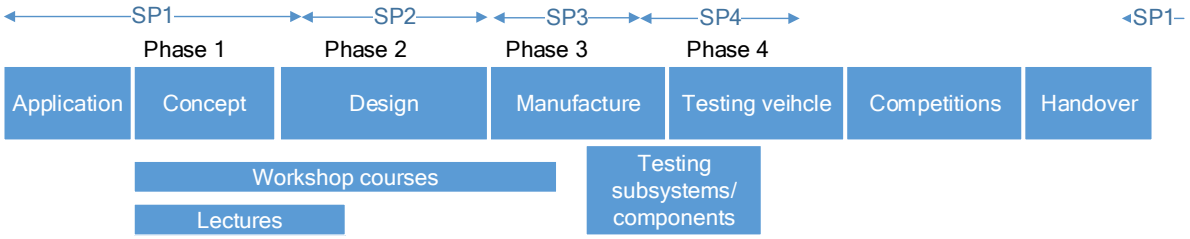

Figure 1. The general time line for the Chalmers Formula Student project.

Time plan

Date	
Application, Study period 1, Study weeks 1 and 2	
2020-08-29 to 2020-09-08	Application period for CFS20. The application procedure is described on the CFS homepage www.chalmersformulastudent.se
2020-09-08 at 23:59	The application deadline
2020-09-14 to 2020-09-18	Interviews. After reviewing the applications the examiner will call the interesting candidates for interviews
2020-09-18	Announcement of team members for CFS20. The team members are selected by the examiner together with student managers based on applications and interviews. The selected students will thereafter be registered on the course Chalmers Formula Student (TME047).
Concept phase, Study period 1, Study weeks 4 to 7 The outcome of the concept phase should be chosen solutions for each subsystem. The technical detail of concept choices can vary, but should be detailed enough such that design work can start. A concept solution could for example specify chassis technology, damper type and damper mounting configuration, battery chemistry/cell type and assembly method, battery location in the vehicle and removal procedure etc. In the concept phase all team members should also gain knowledge about the Formula Student competitions and rules.	
2020-09-22 at 18:00	Start-up team meeting
2020-09-22 to 2020-10-17	The concept phase will include • Introduction to CFS and the CFS20 vehicle • A lecture on the Formula Student challenge • A lecture on electric drive systems for vehicles • Rules quizzes • Introduction to CAD and other software tools • Team building activities
2020-10-22	**Deadline for the concept phase subgroup report**. A template and scope for the report will be provided.
Design phase, From Study period 1 Study week 8 to Study period 2 Study week 8	

The objective of the design phase is to produce a vehicle design in 3D-CAD that is compliant with the FSAE rules and can be manufactured within the resources and time frames available to CFS. At the end of the design phase there should be a manufacturing basis available for all parts of the vehicle.	
	The design phase will include • Lecture on electric drive systems • Compulsory Electric Safety course • Design reviews • An individual presentation of your design work
2020-12-19	Design lock down
Mid-February 2021	**Deadline for the individual design reports**. A template and scope for the report will be provided The individual design report will not be graded at this stage, but individual feedback will be given on the report.
Manufacturing phase, Study week 1 of Study period 3 until end of April In the manufacturing phase the vehicle is produced according to the manufacturing basis of the design phase. The manufacturing phase also includes testing and verification of subsystems.	
2021-04-29	Rolling car deadline
Testing phase, May and onwards In the testing phase the functionality and reliability of the vehicle is verified and the performance is enhanced through tuning and improvement of parts and systems.	
2021-05-14	Public Launch of the running CFS20
Competitions, The intention is that CFS20 should participate in two Formula Student competitions.	
Mid-July 2021	FSN? FS-East?
Mid-August 2021	FSG
Summing up and Handover	
Tuesday in study week 2 of study period 1.	**Deadline for the individual final report**. This is the version of the report that will be graded. It is allowed to make changes to the design part of the report before the final report is submitted. Requirements and a template for the final report will be provided. Late submissions will be reviewed more critically in terms of grading.

In addition to the already planned items in the table above the team should have a weekly meeting where ALL team members participate and a weekly subgroup meeting where supervisors can be present.

During the autumn a metal workshop course and a course on assembly of electrical systems will be given for those that will need the skills during manufacturing.