Course Analysis MF2011

Systems Engineering MF2011 Spring 2024

Date and author: 2024-07-13 by Ellen Bergseth, Examiner and course responsible

Course information

This course is based on an analysis and redesign scenario for an existing technical system combined with lectures, computer exercises, and seminars to support the project and to understand the discipline and practice of systems engineering. The course is given at the Department of Engineering Design at KTH has yearly about 50 to 60 students from three different master programs. The students have a Bachelor's degree in Mechanical Engineering, Design and Product Realisation, or equivalent. More than 30 percent of the students are international students. The primary purpose of the course is to introduce technical complexity and uncertainty, balancing desired and undesired effects when developing a system or product. The students must apply theoretical knowledge in a more practical and bigger picture context. Project work constitutes the main part of the course and is based on an analysis and redesign of an existing technical system. The whole class is one project group with one common goal divided into several subgroups of 4-6 students. That makes it possible to solve problems with a higher degree of complexity. One member of each development group will also be a member of a system integration group responsible for architecture definition, systems model updating, interface flaw detections, system performance verification etc. A stage-gate process and the V-model support the project development progress. Students should put in 240 hours in total, with 60 hours scheduled.

Other teachers in the course:

Zeinab Raoofi, Claudia Andruetto and Bhavana Vaddadi

Learning activities:

Lectures, computer exercises, seminars, project gate meetings, workshops, final presentations, project work (non-scheduled), and individual logbook writing (non-scheduled).

Teacher analysis of the course

This year we added oral examination for the home exam. The oral examination had a battery of questions. Students had 15 minutes to answer at least 2-3 of the questions. The oral exam made it possible to assess if the student understood the learning goals at Level 3 (grade A/B), about 25 students signed up for the oral exam. Level 2 (grade B/C) and Level 1 (grade D/E) did not require an oral examination. Also, this year had three course assistance and industry coaches. The teacher assistants had good insights in systems thinking research, which is important enabler in systems engineering and this strengthen the course, but the many teachers made the course less coherent than having one teacher. This is reflected in the course evaluation. The industry coaches was given a wish list and before the course started, what we expected from them. Also, we had an online introduction to the coaches. Most of the coaches joined the first lecture, about 25% joined the gate meetings. The coaches have long experiences and some gave the chance to visit their companies. Causal Loop Diagram was introduced. Business canvas was introduced as well as a collaboration exercise in the beginning of the course. This course round project was very close to reality as SL was active in the problem definition, better than last course round. The students are mixed having various background, they have different expectations. We do not need so many coaches as we had this year, but what we need is a more in-sync course schedule and goal for the course. Previous course round it was only one teacher and no coaches, involving more people needs more course structure and management. Also, it would probably be nice to do a smaller project to use SE techniques in a more coherent way.

Proposed changes to the next course round

The following should be considered as changes for the next course round:

- The threats and hazard evaluation should be assigned as an assignment, as students were not adequately prepared.
- Add in course PM that for the home exam, the grade may be lowered if the student don't submit in time.
- Interface specifications should be added as an assignment.
- Regarding the CLD parts:
    - Only one group properly followed the instructions. We need to emphasize what is needed from the students or try a different approach to create a more constrained deliverable.
- More information about the subsystem should be included in the background chapter. Add this as Assignment 1.
- The report template should include a section for final insights on the dynamics between different subgroups and within their group.
- Use the Easy Approach to Requirements Syntax (EARS). Helpful for setting a common way of stating requirements for the project.
- Make use of the system Polarion for handling requirements.
- Start the project with a focus on the work in sub-groups without appointing a SIG member initially.
    - Don't bring in guest lecturers too early; focus on starting the project and understanding the systems first.
    - Once initial tasks like system requirements are done, then appoint the SIG member (possibly rotating this role during the course) and start guest lectures.
- Choose literature that is more connected to the project, such as understanding parts of the subsystem or systems engineering.
- Address attendance issues:
    - Some students faked attendance early in the course.
    - Consider calling roll or asking who is missing in each group.
- Assign a project manager in each subgroup to lead the group work.
- Improve collaboration by dedicating time during lectures and workshops early on for group communication.
- SE at SAAB:
    - The exercise during the lecture was very educational.
    - It covered system requirements and the resulting conflicts and demands.
    - This lecture should be earlier in the course.

Summary of the course evaluation

This summary was made by AI, chatGTP, having the course evaluation as input. It captures the main points from the course evaluation, highlighting areas of strength and opportunities for improvement. Even though the home exam gave a lot of insights about the course quality from individual students that is not anonymous as this course evaluation that 27% answered.

The average weekly workload reported by students varied. Some students noted an imbalance in workload, especially for those in the SIG group, who experienced at least 50% more work for the same amount of credits.

Best aspects of the course

Students appreciated different elements: The complexity and real-world application of system engineering. Working on interesting projects like the SL yellow line. The concept of working in subgroups, which felt representative of real-world projects. Industrial mentors and teachers with a positive attitude. The large project setting, which was stimulating and practical, providing a glimpse of real-life work

Suggestions for Improvement

Suggestions for course improvements included: Streamlining and reducing the number of different deliverables and sessions to allow more focus on the main project. Better defined work structure and clearer goals. Removing or improving seminars and focusing on practical communication practices and discussions. Starting the project earlier in the course. Adjusting the workload for SIG members and making the SIG group a separate entity.

Learning Experience Questionnaire (LEQ) Statements

The average response to LEQ statements showed varied feedback: Students felt the course was somewhat stimulating and inclusive. Goals and organization received mixed reviews, with some students finding them clear and others not. Concrete examples and key concepts were generally understood. Constructive alignment and feedback were areas with room for improvement.

General Feedback and Additional Comments

Many students appreciated the practical aspects of the course and the industrial mentors. There were concerns about the fairness of the workload distribution, particularly for SIG members. Some students felt that certain course elements were repetitive or unnecessary. Recommendations for future participants included maintaining good communication, taking full advantage of mentors, and focusing on documentation and integration of the project.