

Course Memo
LIFE CYCLE ASSESSMENT

Credits: 7.5 hp
Course code: AG2800
Year: 2019

Welcome to the course in Life Cycle Assessment!

This course memo contains important information about the course.

Please take your time to read it carefully!

Then read parts of it again before every lecture, computer lab, supervision meeting, or seminar.

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ADMINISTRATIVE INFORMATION

Any questions related to course organisation, lectures, seminars etc., should primarily be directed to the course assistant.

Course assistant

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Contact for questions about Canvas, schedule, signing up for seminars and computer labs.

Lecturers

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Project supervisors

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Course coordinator and examiner

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Overall responsible for course content and examination

Dept. course administration

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Contact for questions about admission and registration.

Teaching unit: Dept. of Sustainable development, Environmental science and Engineering (SEED).

Visiting address: Teknikringen 10B

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COURSE CONTENT AND INTENDED LEARNING OUTCOMES

Intended learning outcomes

The overall aim of this course is to develop your skills of systems thinking in environmental issues, related to your own area of expertise. This course will give you a basic analyst's competence in Life Cycle Assessment (LCA).

After completing the course, you should be able to:

1. Explain the overall purpose and principles of LCA.
2. Discuss possible applications and limitations of LCA.
3. Describe the content and explain the purpose of the analytical steps of LCA.
4. Carry out a complete LCA of a product or service system, including:
 - identify and delimit the system,
 - specify and handle allocation problems,
 - identify and use relevant data from LCA databases,
 - collect and use data from other sources,
 - choose characterisation method based on coverage and relevance to the intended application,
 - implement and use a computer model of the system in the LCA software SimaPro,
 - analyse, explain, and interpret model results.
5. Write a report of the performed LCA, applying the reporting guidelines and terminology as defined in the ISO standard for LCA.
6. Make a critical review of another LCA.

Course main content

The course includes lectures, computer exercises and a group project.

Lectures will cover the following areas:

- LCA in relation to other environmental systems analysis tools.
- Methodology for the different phases of an LCA (goal definition and scoping, inventory analysis, impact assessment and interpretation).
- Methodology for simplified LCA.
- LCA software tools and databases.
- Critical review of an LCA study.
- Application areas of LCA and limitations.

Groups of 4 students perform LCA using the software SimaPro. Projects are presented in a report and at a seminar. Each group will also make a critical review of the LCA of another group.

SCHEDULE, DEADLINES, AND WORK LOAD

Schedule

- **TimeEdit:** The schedule with lectures, seminars, and computer labs is available in TimeEdit: <https://www.kth.se/en/student/schema/sok-schema-1.2214>
- **Canvas:** Detailed schedule with deadlines for assignments and self-sign up for supervision appointments is available in Canvas Calendar. Note that you need to add the course AG2800 to your Canvas Calendar in order to see calendar events and use Scheduler to sign up for supervision.

Deadlines

Home exam

- **Monday, November 18 (8.00):** Home exam opens.
- **Tuesday, November 19 (18.00):** Submission home exam.

Pre-seminar reflection

- **Monday, November 25 (18.00):** Submission "*Pre-seminar reflection*".

Peer review and assessment seminar

- **Wednesday, December 11 (18.00):** Submission "*Draft project report, before peer review seminar*".
- **Friday, December 13 (18.00):** Submission "*Peer review assessment*".

Final seminar

- **Friday, December 20 (18.00):** Submission "*Project report, before final seminar*".
NOTE: version of the report will be graded.
- **Wednesday, January 8 (18.00):** Submission "*Critical review*"
- **Monday, January 14 (18.00):** Submission "*Revised project report after final seminar.*"

Work load

This is a 7.5 credit course, corresponding to 5 weeks of full time work. You should expect to spend roughly the following amount of time on different parts of the course:

Note: week 47 (Nov 18 – Nov 22) will be especially intense, with pre-seminar and home exam! Take this into account when you plan your work.

Scheduled studies (~1 week)

- Lectures: 20 h
- Computer labs: 12 h
- Supervision meetings: 4 h

Own studies (~4 weeks)

- Reading course literature: 1 week
- Completing home exam: 6-8 hrs (if you have done the reading before the exam!)
- Project work: 2.5 weeks
- Critical review and final revision of report: 0.5 week

COURSE REGISTRATION

Registration is possible when you have been admitted to the course. Register on-line during the first week of the course through your personal menu at kth.se. You must register to attend the course and to have access to Canvas.

If you encounter problems when registering, please contact the department's course administrator (kursadmin.seed@abe.kth.se).

Students who have not applied to the course when the course starts must contact their student counselor or program coordinator. This is your own responsibility and it cannot be arranged by the course coordinator.

STUDENTS WITH DISABILITIES (FUNKA)

Students with a disability may contact the KTH coordinator for students with disabilities (Funka) for support: funka@kth.se

It is your own responsibility to inform the teacher regarding any need for compensatory efforts from the teachers that you may have and that have been decided by Funka.

LECTURES (L1 – L10)

The lectures cover LCA methodology as a complement to the course literature. It is important to attend lectures and read the corresponding literature to be able to work efficiently in your project.

The following overview of lectures indicates what parts of the course literature relates to the topic of each lecture. Use this as a help to plan your studies and to find the right literature when working on your projects.

By the time of the home exam, you need to have already studied the literature and lecture notes. Experience from students earlier years tells that it will otherwise be a very stressful exam.

You are encouraged to do the exercises in the course book, ideally together with fellow students in the course, but we do not work on these together in class.

L1 - What is LCA? & Course overview

Lecturer: Anna Björklund

Content: Introduction to key features of LCA to give an overview of course content and a possibility to start reflecting over how LCA can be used in various fields of industry and society. Throughout the remainder of lectures, LCA methodology will be covered in depth.

We will also go through practical issues and course design in this lecture.

Literature for L1:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Preface and Chapter 1.
- PRÉ Consultants (2016) *Introduction to LCA with SimaPro*. Chapter 1.

L2 – Forming project groups & Goal and scope definition

Lecturer: Anna Björklund

Content 1st hour: How to set up and design a LCA study. Understanding this phase (Goal definition and scoping) of LCA is important for you to make an adequate and meaningful formulation for the topic of your project. This is necessary as background for the first project supervision meeting (PS1).

Content 2nd hour: We will brain storm about project ideas and form project groups (4 members per group). Please prepare before Lecture 2 by thinking of topics that you would like to work with in your projects.

NOTE: If you miss this lecture, you need to contact the course coordinator ASAP in order to make sure that you join a project group!!! Project groups start working already during the first week of the course.

Literature for L2:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 2.
- PRÉ Consultants (2016) *Introduction to LCA with SimaPro*. Chapter 2.

L3 –Goal and scope definition continued.

Lecturer: Anna Björklund

Content: Goal definition and scoping continued (2h).

Literature for L3:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 2.
- PRÉ Consultants (2016) *Introduction to LCA with SimaPro*. Chapter 2.

L4 - Inventory analysis. The Ecoinvent database

Lecturer: Anna Björklund

Content: Constructing a flow model and collecting data of the technical system. Understanding this phase of LCA is important for you to make a detailed description of the technical system of your project, and to start collecting relevant data. This is necessary as background for the 2nd project supervision meeting (PS2). A few words about the Ecoinvent database.

Literature for L4:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 3.
- PRÉ Consultants (2016) *Introduction to LCA with SimaPro*, chapter 3.
- Finnveden, G., Hauschild, M., Ekvall, T., Guinée, J., Heijungs, R., Hellweg, S., Koehler, A., Pennington, D., and Suh, S. (2009) Recent developments in Life Cycle Assessment. *Journal of Environmental Management* 91, 1–21.

Videos for lecture 4:

- “Ecoinvent in a nutshell” <https://www.youtube.com/watch?v=xOdZcWNpIso>
- Ecoinvent webinars, for further understanding of the Ecoinvent database (not compulsory) <http://www.ecoinvent.org/support/webinars/webinars-and-recordings.html>

L5 – Impact assessment

Lecturer: Göran Finnveden

Content: Principles and methods for impact assessment in LCA. Understanding this phase is important when you start interpreting the results of your project. This is necessary as background for the 3rd project supervision meeting (PS3).

Literature for L5:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 4.
- PRÉ Consultants (2016) *Introduction to LCA with SimaPro*. Chapter 4.1 - 4.4.
- Finnveden, G., Hauschild, M., Ekvall, T., Guinée, J., Heijungs, R., Hellweg, S., Koehler, A., Pennington, D., and Suh, S. (2009) Recent developments in Life Cycle Assessment. *Journal of Environmental Management* 91, 1–21.
- Huijbregts et al. (2017) ReCiPe2016: a harmonised life cycle impact assessment method at midpoint and endpoint level. *Int J Life Cycle Assessment*, 22:138, 138-147.

L6 – Weighting, normalisation and interpretation

Lecturer: Göran Finnveden

Content: Methods for further aggregation results, as an aid to interpret the impact assessment results. This is necessary as background for the 4th supervision meeting (PS4).

Literature for L6:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 5.
- PRÉ Consultants (2016) *Introduction to LCA with SimaPro*. Chapter 4.5 – 4.6.
- Hellweg, S. and i Canals, L. M. (2014) Emerging approaches, challenges and opportunities in life cycle assessment. *Science*, 344, 1109-1113.

Lecture 7 – Data quality, uncertainty, representativity

Lecturer: Anna Björklund

Content: Overview of Social LCA, its main characteristics, methodology and guidelines.

Literature for L7:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 6.3.

Lecture 8 – Social LCA

Lecturer: Elisabeth Ekener

Content: Overview of Social LCA, its main characteristics, methodology and guidelines.

Literature for L8:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 7.4.
- Wu, R. Yang, D., and ChenWu, J. (2014) Social Life Cycle Assessment Revisited. *Sustainability*, 6, 4200-4226.

Lecture 9 – Modelling bio-based systems in LCA

Lecturer: Miguel Brandão

Content: Modeling of biogenic carbon cycles in LCA.

Literature for L9:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 3.3.6.
- Schmidt et al. (2015). A framework for modelling indirect land use changes in life cycle assessment. *Journal of Cleaner Production*, 99, 230-238.
- Brandão, M. et al (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. *Int J of Life Cycle Assessment*, 18, 230-240.

Lecture 10 – LCA in Practice

Lecturers:

- Michael Martin, IVL Swedish Environmental Research Institute (1 hr)
- TBD (1 hr)

Content: Invited speaker from industry present examples of using LCA in practice for strategic and operational sustainability work their organisations.

Literature for L9:

- Curran, M. A. (2015) Life Cycle Assessment Student Handbook. Chapter 6.8.

COMPUTER EXERCISES (C1 – C6)

Computer rooms: Throughout the course, SimaPro is available in the computers labs at Drottning Kristinas väg 30 (Bure, MacLean, Faggot) and Teknikringen 76 (Christopher, Nils Baltzar).

There are six scheduled meetings in the computer lab, with teachers present to help you out with exercises and working on your projects.

You need to work on your own at other times in the computer lab with exercises and projects! Learning to use SimaPro early on in the course is important to be able to complete a successful project.

C1-C2 instructions: Run the SimaPro demo, tutorial, and do exercises

1. Work with your project group, but split in two small groups when working on demo, tutorial, and exercises.
2. Follow the steps outlined in “*Instructions to SimaPro demo and exercises in AG2800*” available in Canvas/Modules (see below).
3. First, run the SimaPro demo.
4. Next, do the exercises “Create a simple SimaPro model”.
5. Finally, complete the SimaPro tutorial (only the parts indicated in the instructions)

NOTE: These steps should be completed before the third meeting (C3) in the computer lab. This probably means that you will need to schedule own meetings with your group, in addition to C1-C2, in order to have time to do this.

Literature for C1-C2:

- *Instructions to SimaPro demo and exercises in AG2800* (instructions to C1-C2)
- PRé Consultants (2016) *Introduction to LCA with SimaPro*.
- PRé Consultants (2014) *SimaPro Tutorial*

C3 – C6 Own project modelling in SimaPro

From now on, you should work with your entire project group as you start building your model in SimaPro. Only one computer at a time can be logged into a specific project model.

The remaining C3-C6 are scheduled to make sure you have time to meet a teacher to ask questions about modelling in SimaPro. No joint exercises are planned for C3-C6- You also need to schedule own time with your project group in the lab, since time during scheduled computer labs will not be enough.

Course requirement – Computer exercises

Minimum attendance at 5 (out of 6) computer exercises is required. Inform your group if you are not able to attend and make agreements on how to catch up.

NOTE: Don't forget to sign the attendance list!

WRITTEN HOME-EXAM

A written home-exam is given at mid-term. The purpose of this exam is to ensure that all students learn the basics of LCA methodology necessary to actively contribute in a good way to the group projects.

Please check info about deadlines above in this document for dates when the exam opens and should be submitted.

The exam covers Lectures 1-6 and the corresponding literature. You will be tested for knowledge of LCA terminology through multiple choice questions (part A), ability to apply LCA knowledge to explain or draw conclusions (part B), and ability to apply LCA knowledge to make own LCA calculations (part C).

Make sure to study the literature along with the lectures in advance. Starting to read when the home exam opens is not a good path to success and will be very stressful!

Instructions

- The exam is posted and uploaded on-line in Canvas under Assignments.
- The exam is open for two days. You can work on the exam anytime while it is open in Canvas. Make sure to save often while working. It also saves automatically. You do not have to complete the whole exam at once.
- Any aid (eg. course book, collaboration with friends) is allowed, even encouraged! Working on the exam together is a way to better learning.
- **Plagiarism is not allowed!** This includes copying answers from other students, from the course book or other written sources. Exams are automaticall checked for plagiarism. Answers with high degree of similarity between each other will be assessed as failed (F).
- The exam is graded A-F.
- Exams that are graded as Fx (fail with the possibility of supplementing to a Pass) will require supplementing through an oral exam. After supplementing, the exam can only be graded as E.

Course requirement – Written exam

To pass the course, you need to acquire the grade E or higher on the exam. Exams graded as Fx (fail with the possibility of supplementing) will require supplementing through an oral exam. After supplementing, the exam will be graded as E.

PROJECTS AND PROJECT REPORTS

The aim of the project is to put theory from lectures and the course literature into practice, and to give practical experience of LCA modelling with LCA software.

Project group agreement

Co-operating in projects is sometimes challenging. Group members may have different ambition level, different communication styles, or different expectations on each other, all of which can be a source of conflicts. One reason to work in projects during your education is to experience this and to learn how to resolve difficulties in a professional way. The project requirements and supervision in this course are designed in part to help you to plan your project in a way so that problems are avoided.

As a way to prevent, as far as possible, misunderstanding or conflicts between project group members, there is a “Project group agreement” form for each group to fill in.

Please contact your group supervisor at an early stage if you experience problems of co-operating in your group that you don’t know how to resolve yourselves, so that we can find a way to help you.

Course requirement – Project contract

Each group must fill in a “Project group agreement” (available in Canvas) and save among its project documents.

Select topics and form project groups

Projects are performed in groups of 5 students. Together with other students you will define your own project topic, on your own area of expertise and interest.

- **Before Lecture 2:** Prepare by thinking of areas/topics/research questions that you would like to work with in your projects. Talk to your class mates before hand or use the discussion forum on Canvas (Discussions/Select topics and form project groups) to find others interested in your idea.
- **Tips for finding a good topic:** We strongly recommend that you choose a topic that you already have some knowledge of. Also, the more narrowly defined your research question is (focusing on very specific details), the more difficult it will be to find relevant data, but with own experience from the field you may be able to overcome these problems.
- **During Lecture 2:** We will brainstorm in class and list your topics of interest to help you to form groups.

Sign up for project groups in Canvas

During Lecture 2: Once you have formed your project group, you will be given a group number. You must then sign up in your group on Canvas.

- Under People/Project groups you find a list of project groups (Project group 1-20).
- Each student logs in to Canvas and joins the assigned project group.
- Edit the group name to reflect your topic (for example: “Project Group 1 – electric vehicles”)

Sign up for project supervision (PS) meetings

You will meet four times with your supervisor (PS1-PS4).

- **After lecture 2** you will be assigned a supervisor. Teachers will notify each group by email, so make sure to check your email during the afternoon!
- **Sign up for PS1-PS4:** Sign up for PS with your supervisor in Canvas using the Calendar. We advise you to sign up for all supervision meetings at once. On Canvas, there is a guide on how to sign up for supervision.
- **Note:** You need to sign up for PS1 already on Friday the first week of the course.

Prepare for project supervision

- Prepare before meetings according to instructions in “*Instructions for project supervision meetings in AG2800*”.
- **Attendance:** The entire group must attend each meeting! Should you for some reason absolutely not be able to attend, you must confirm in advance with your group and your supervisor that absence will be OK, and make an agreement how to catch up.
- **Professional attitude:** Coming well-prepared to every meeting, can improve your final grade, since the work process as such is also assessed.

Course requirement – Project supervision meetings

You are required to attend each supervision meeting. Failing to show up for supervision, for whatever reason, without having made a sincere effort to contact your group and supervisor to reschedule the meeting, will affect your grade negatively.

Each group member must act as “coordinator” at one meeting, with responsibility to present the work of the group to that date, questions, or any other issues. Failing to take this role seriously will affect your grade negatively.

Project log book

The day before each supervision meeting, short notes must be prepared according to the instructions in “*Instructions for project supervision meetings in AG2800*”, uploaded to Canvas (Assignments/Logbook for supervision), and brought to the meeting.

Course requirement – Project log book

Before each supervision meeting, each group should update their log book and upload on Canvas. Failing to manage your log book properly will affect your grade negatively.

Project reports

Each group writes a report (15-20 pages). Detailed instructions on format and content are found in the document “*Instructions for project supervision meetings in AG2800*”.

Course requirement – Project report

Hand in report according to instructions on format and content.

PRE-SEMINAR

Each group will present its draft report at a pre-seminar, attended only by students. The purpose is to give you the opportunity to get feedback on your own project and to learn from the work of other students.

All groups will be responsible for giving peer feedback on another project. You will not prepare any feedback before the seminar, but during the seminar you will take the lead in asking questions and giving feedback. After the seminar each group should write and submit a brief summary and feedback.

Before the pre-seminar

- Sign up for pre-seminar times in Canvas (using the Calendar).
- You must attend the entire pre-seminar (2h) when your own project is presented.
- You do NOT need to submit anything before the pre-seminar.
- Prepare a 10 min presentation that you can re-use and develop further for the final seminar. The pre-seminar presentation should only cover:
 - Goal & scope,
 - Life cycle inventory analysis, and
 - Brief outline of expected results and interpretation.
 - Questions that you would like feedback on from other students.

During the pre-seminar

A teacher will be present at the beginning of the seminar to get you started, and at the end to answer any remaining questions from the presentations. Therefore, take notes of unresolved questions during the seminar.

- Bring the presentation on your own laptop.
- All group members must participate in the presentation.
- You will be assigned “peer-feedback group” for another project.
- Outline of presentation (total 25 min per group):
 - **10 min** presentation by project group
 - **15 min** discussion. The responsible peer-feedback group starts by giving feedback and asking questions. After this, others can ask questions.

(continued on next page)

After the pre-seminar: Written feedback and reflection

After the pre-seminar, each peer-feedback group writes a feedback about the project that you were assigned to give feedback on, as well as a reflection on your own project.

Include the following (about 1 page):

- Summarise in about 10 sentences your understanding of the other group's project (rationale, aim, expected outcome).
- Comment on two (or more) things about the project that was particularly good/inspiring/creative. **Explain and motivate.**
- Suggest two (or more) things that could be improved in the project. **Explain and motivate.**
- Mention two things (or more) that you will improve in your own project, as a result of what you learned from others during the pre-seminar.

Upload your Written feedback and reflection in Canvas after the pre-seminar (Assignemnts/Pre-seminar reflection). Please check info on deadlines above in this document.

Written feedback and reflection from all groups will be posted on Canvas for everyone to read.

Course requirement – Pre-seminar

You must attend the entire pre-seminar when your project is presented, participate in your own group's presentation and peer feedback on other groups.

Each group must write a feedback and reflection document of the pre-seminar, and upload it in Canvas according to instructions.

PEER REVIEW SEMINAR

At this seminar, we will go through the template for grading of project reports. Each group will be assigned one report of another group to assess.

Assessments should be submitted in Canvas (Assignments) the day after the seminar and will be shared with all groups (Modules).

NOTE: The assessment of another group is NOT a formal basis for grad. The purpose of this exercise is for all groups to better understand the grading criteria, to reflect on one's own writing by reading the report of another group, and to provide helpful feedback to that group to be used when finalising the reports.

Before the Peer review seminar

Before the seminar you must submit your Draft project report on Canvas (Assignments). Please check info on deadlines above in this document.

After the Peer review seminar

After the seminar you must submit your assessment on Canvas (Assignments). Please check info on deadlines above in this document.

Course requirement – Peer review seminar

Submit the Draft project reports according to instructions.

You must attend the entire peer review seminar, but also spend more time on the exercise after the seminar since it will be difficult to finish within the scheduled time.

Submit the assessment of another group's according to instructions.

CRITICAL REVIEW OF PROJECTS BEFORE FINAL SEMINAR

Each project group shall prepare a written critical review of the project report of another group. Critical review is an important procedure for quality assurance of LCA, and an important part of scientific methodology in general.

Instructions

- When project reports have been submitted before the final seminar, they will be uploaded in Canvas for all students to see (Modules). You will be informed about what report to review, and you should download it from Canvas.
- The critical review should be prepared and presented according to the instructions in “*Instructions for report & critical review in AG2800*”.
- Submit your critical review in Canvas (Assignment/Critical review of project report). Please check “Schedule, deadlines” above in this document.
- At the final seminar, all groups members should make an oral presentation of the critical review and discuss their feedback with the group that they have been reviewing.
- After the final seminar, the written critical reviews will also be shared on Canvas (Modules/Project work).

Literature for critical review:

- *Instructions for report & critical review in AG2800*
- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 6.7

Course requirement – Critical review

Each group shall prepare and present a written critical review of the project report of another group. Submit according to instructions.

FINAL SEMINAR AND REPORT SUBMISSION

Project reports are presented at a final seminar. This is the final examination of the course. Comments on your report will be presented at the seminar by a critical review group.

NOTE: The report that you submit before the final seminar is the one that is graded. Revisions after the seminar are only to complement if any aspects are not yet assessed as complete.

Before the final seminar

- Submit your report in Canvas (Assignment/Project report). Please check info on deadlines above in this document.
- See separate instructions on report format (“*Instructions for report & critical review in AG2800*”). It will be automatically checked for plagiarism.
- Prepare a critical review of the project report of another group. See separate section in course memo (“*Instructions for report & critical review in AG2800*”).

At the seminar

- Each seminar (4 h) includes 5-6 presentations.
- Each group has 30 min at its disposal, including:
 - 15 min presentation (beware that this is short and requires careful planning!)
 - 10 min critical review
 - 5 min comments and questions from the rest of the audience
- All group members must participate in the preparation and presentation and be able to answer questions related to the entire project.
- Bring your own laptop for the presentation.

After the final seminar

- After the seminar you will receive written feedback from your supervisor with grade and required amendments. The grade will be your final grade if you manage to make the required amendments. Otherwise you may receive a lower grade.
- Final revised reports shall be handed in at Canvas (Assignment/Revised project report).
- Please check info on deadlines above in this document.

Course requirement – Final seminar

Submit report according to instructions.

Attend and participate actively in the entire final seminar when your project is presented.

Submit final revised report according to instructions.

EXAMINATION AND GRADING

The course examination consists of the following parts:

- Written exam (2,5 hp), grade scale: A, B, C, D, E, FX, F
- Project report (4.5 hp), grade scale: A, B, C, D, E, FX, F
- Critical review (0.5 hp), grade scale: P, F

The final grade (A-F) is a weighted average of the written exam and the group project assignment, with the project weighted slightly less than its corresponding credits (Exam = weight 2.5; Project = weight 4).

In order to receive a final grade, the requirements for an “E” for the written exam and project assignment must be fulfilled, and "Pass" grade on the critical review is required.

Fx represents a failing grade which lies on the boundary between pass/fail, and can be complemented to reach the grade E.

Failing to meet course requirements related to project work (attendance and active participation at seminars and supervision, deadlines) is considered a badly handled working process and will affect your grade negatively.

Written mid-term home exam (2.5 hp, A-F)

- The written exam covers intended learning outcomes 1-3 (*Explain overall purpose and principles of LCA; Discuss possible applications and limitations of LCA; Describe the content and explain the purpose of the analytical steps of LCA*).
- The written exam is graded A-F.
- Fx denotes a failed grade, but with the possibility to pass the written exam by oral examination. After oral examination, the student can only receive the grade E.

Critical review (1 hp, P/F)

- This examination item examines intended learning outcome 6 (*Make a critical review of another LCA*).
- This examination item consists of two exercises; the “Peer review and assessment seminar” and the critical review done in advance of the final seminar.
- The Critical review is assessed as pass/fail (P/F). To pass this assignment, it should be prepared and presented according to the instructions.

Group project assignment (4 hp, A-F)

- The group project examines intended learning outcomes 4-5 (*Carry out a complete LCA of a product or service system; Write a report of the performed LCA*).
- The project assignment is graded A-F (see grading criteria below). The grade of the project assignment is based on the following factors:
 - o *Report content* (your understanding of LCA methodology, and ability to design and perform an LCA study)
 - o *Report formal qualities* (outline, clarity, language, referencing).
 - o *Performance* (group and individual student) at supervision meetings and at final seminar.
 - o *Course requirement fulfillment*, regarding attendance at supervision, computer labs and seminars and meeting deadlines.

Upping and appealing a grade

Rules for upping and appealing grades apply according to student rights at:

<http://www.kth.se/en/student/studentliv/studentratt/overklagan-overklagande-av-myndighetsbeslut-1.323892>

Evaluation criteria for group project assignment

Aspects and assessment criteria	A	C	E	Fx
A. Report content				
LCA methodology	LCA methodological aspects are correctly defined and used wherever necessary.	LCA methodological aspects are for the most part correctly defined and used wherever necessary.	Some important errors in documentation and use of LCA methodological aspects, but that did not entirely mess up the project design and results.	Severe mistakes or gaps in LCA methodology that cannot be easily corrected or explained in revision of final report.
Clarity and completeness	Content is clear, precise, and complete, so that the reader gets a good understanding of background, methodological choices, scope of the project etc.	Content is for the most part clear, precise, and complete, so that the reader gets a fairly good understanding of the project.	Content mirrors aim of the project, but with some serious unclarity in content.	Because of lacking or unclear information the content does not give the reader a good understanding of the project.
Relevance and conciseness	Content is well delimited, including only relevant content with regard to the goal of the LCA.	Content is for the most part well delimited, including only relevant content with regard to the goal of the LCA.	The report is readable with regard to relevance of content.	The report is difficult to read because of too much irrelevant content.
Documentation of data	Data documentation is complete and transparent, so that the reader easily understands how the project was modelled.	Data documentation is for the most part complete and transparent.	Documentation of data is not complete and transparent, but gives the reader some basic understanding of how the project was modelled.	It is not possible from the documented data to get a general understanding of what was modelled and how.
Response to research question	Clear connection problem- goal - results - discussion - conclusions.	For the most part clear connection problem- goal - results - discussion - conclusions. Some aspects missing.	There is some connection problem- goal - results - discussion - conclusions, but in general it is not well organised.	Problem and goal of study are not mirrored in results, discussion, conclusions.
B. Written presentation, language and format				
Language	Excellent language throughout report, both in terms of spelling and grammar, and reader friendliness of the text.	Mostly good language, both in terms of spelling and grammar, and reader friendliness of the text.	Report is readable.	Bad language, so that the content is difficult to understand.
Disposition and coherence	Content is well-disposed, coherently and logically structured, follows outline in report instructions, and easy to follow.	Content is mostly well-disposed, follows outline in report instructions, and mostly easy to follow.	The report outline for the most part follows the report instructions, but is not easy to follow.	Many deviations from report instructions, without apparent reason.

Aspects and assessment criteria	A	C	E	Fx
Figures and tables	All figures and tables are relevant and contribute to the content, have legends using consistent format, are consistently numbered, and are referred to and explained in the text.	Most figures and tables are relevant to the content, have legends, are numbered, and are referred to in the text. Explanations are missing or are incomplete.	Figures and tables have legends and are mentioned in the text, but either are not explained in the text or are not relevant.	Figures and tables are not included in a way that contributes to the understanding of the text. Legends missing. Not explained in the text.
References	References are included wherever necessary, in a way that would be acceptable in a scientific context (complete and consistent).	References are included in a mostly complete and consistent way.	References are used so that it is mostly clear when information comes from other sources, but are not complete and consistent.	Many important references are missing. References not used in a consistent way.
C. Oral presentation				
Final seminar, group	Very well disposed presentation, with regard to content of slides and presentation, that gives a good understanding of the project. Content presented within time limits.	Mostly well disposed presentation, with regard to content of slides and presentation, Time limits not severely surpassed.	Presentation and slides cover most relevant parts of the project. Time limits not severely surpassed.	Presentation does not communicate content of project. Severe surpassing of time limits. Very unbalanced contribution by group members.
Final seminar, group	All group members actively and equally involved in presentation and discussion.	All group members contribute, but with some unbalance of contribution.	All group members contribute, but with very uneven contribution.	Very unbalanced contribution from project members, so that some totally dominate alternatively are not given room to contribute.
Final seminar, individual	The student shows very good ability to meet the opposition at the final seminar, with clear argumentation and reflection based on the course literature and other literature used in the project.	The student is able to meet the opposition at the final seminar, and to discuss the project in a way that shows basic understanding of LCA methodology.	The student shows basic understanding of own project, and is able to answer questions directly related to own subject.	Student is not able to answer basic questions related to own project at the final seminar.
Supervision meetings, individual	The student participates actively in the discussion at supervision meetings, showing good understanding of LCA methodology and own project topic.	The student participates in the discussion at supervision meetings, mostly showing understanding of LCA methodology and own project topic.	Student is mostly able to answer basic questions directly related to LCA methodology and own project topic.	Student is not able to answer basic questions related to LCA methodology and own project during supervision.
D. Group process				
Professional project management	The group comes well-prepared and on time to supervision. It is clear that the group actively includes all group members in the project. Problems are communicated at an early stage to supervisor.	The group comes prepared and on time to supervision. All group members make some contribution during supervision.	The group mostly comes prepared and on time to supervision.	Group repeatedly does not show up on time. Group fails to communicate problems in time so that the project work does not proceed.

Aspects and assessment criteria	A	C	E	Fx
Independence	The group is able to independently and in a creative manner manage the research, including identify and delimit research question, data needs, assessment, and interpretation. The supervisor is consulted for feedback.	The group is sometimes able to independently manage the research, including identify and delimit research question, data needs, assessment, and interpretation. The supervisor often has to interfere to point out necessary next steps in the project.	The group is able to complete the project assignment, but with no or little independence in relation to the supervisor.	The group work does not proceed without repeated interference by the supervisor.
Log book and deadlines	The group uses the log book in a good way to plan and show progress of the project, according to instructions. Submissions of log book and other project deliverables meet deadlines.	The group uses the log book in a way that shows progress of the project. Submissions of log book and other project deliverables mostly meet deadlines.	The group uses the log book, but not in a good way to plan and show progress of the project. Project deliverables are submitted, but often fail to meet deadlines.	Group repeatedly fails to use log book and/or repeatedly fails to meet deadlines for project deliverables.
E. Individual process				
Student shows understanding of project and LCA methodology during supervision and seminar. Does this without interfering with a positive work environment and dynamics in the project group.	Much better than average in the group	Average in the group.	Much below average in the group.	Failing to meet requirement for Pass, without communicating and resolving issues with course responsible.
Meets requirements of attendance, or otherwise handles motivated absence in a professional way in dialogue with supervisor and rest of the group.	Much better than average in the group	Average in the group.	Much below average in the group.	Failing to meet requirements, in a way that interferes negatively with the project work.

HOW TO USE CANVAS

All registered students have access to Canvas.

We use Canvas for course material, management of project groups, and submission of exam and reports. We also communicate with students by sending messages through Canvas.

IMPORTANT!!!

Make sure that your e-mail address registered in Canvas is the one that you use and read regularly. If not, you will miss important information sent by your teachers from Canvas. You can change the registered e-mail address by changing your personal settings in Canvas.

Syllabus: Shows an overview of the course - including dates for lectures and assignments.

Modules: All course material is organised in Modules (course memo, power points from lectures, course literature, SimaPro manuals and instructions for computer labs, information about the project work, and links to all your assignments).

Discussions: Discussion forums on various topics. You can use the pre-made discussion topic or create your own.

Assignments: This is where you hand in all your assignments and the supervision log-books.

People: Here you find a list of all the other students in the class. Under “[Project groups](#)” you find all the project groups.

Grades: Here you can find the grades on your assignments and comments from the teachers.

Calendar: Course schedule with all your lectures, seminars, computer labs, and assignment deadlines. Here you also find appointment slots where you can sign up for project supervision, seminars, and computer labs.

LITERATURE

All course material, except the course book, are available in Canvas.

Book

Curran, M. A. (ed) (2015) *Life Cycle Assessment Student Handbook*. Wiley.

You can order this book from for instance AdLibris (www.adlibris.se) or Bokus (www.bokus.se). It will not be available at the student book store, simply because it would be much more expensive.

Scientific papers

As listed under each lecture above in this document. Available in Canvas (Modules/Course literature).

SimaPro manuals

PRé Consultants (2016) *Introduction to LCA with SimaPro*

PRé Consultants (2014) *SimaPro Tutorial*

Other

Instructions for project supervision meetings in AG2800

List of usefull LCA data sources in AG2800

Instructions for report & critical review in AG2800

Instructions to SimaPro demo and exercises in AG2800