

Course Memo
LIFE CYCLE ASSESSMENT

Credits: 7.5 hp
Course code: AG2800
Year: 2015

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 coordinator.

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Web-site: <https://www.seed.abe.kth.se/om/avd/fms>

COURSE AIM, CONTENT, AND WORK LOAD

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:

- Explain the 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.
- 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.
- Write a report of the performed LCA, applying the reporting guidelines and terminology as defined in the ISO standard for LCA.
- 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.

Time/work load

From experience, we know that some students realise towards the end of the course that they did not plan to allocate enough time to course work. A 7.5 credit course corresponds to 5 weeks of full time work. You should expect to spend roughly the following amount of time in the course:

Scheduled

- Lectures: 18 h
- Computer labs: 12 h
- Supervision meetings: 4 h

Own studies, estimated time

- Reading course literature: 1 week
- Completing home exam: 5 h
- Project work: 2.5 weeks
- Critical review and final revision of report: 0.5 week

SUBMISSION DEADLINES

Dates for lectures, computer labs and seminars are listed in the schedule in KTH Social. In addition, the following important dates apply.

Home exam

- **Thursday, November 19 (at 8.00):** Home exam posted in Bilda.
- **Monday, November 23 (at 9.00):** Deadline submission of home exam in Bilda.

Pre-seminar

- **Monday, November 30 (at 9.00):** Deadline for submission of summary and reflection from pre-seminar in Bilda.

Final seminar

- **Friday, December 18 (at 17.00):** Deadline submission of reports before the final seminar in Bilda.
- **Tuesday, January 12 (at 17.00):** Deadline submission of critical review in Bilda
- **Monday, January 18 (at 17.00):** Deadline submission of final revised report in Bilda.

COURSE REGISTRATION

Please register on-line for the course through My Pages → Registrations. You will immediately see in your personal menu when you have registered successfully. If you encounter any problems when registering, please contact the education office (Teknikringen 74).

Students must register for the course. If you are not registered, you are not allowed to attend the course, your grades will not be reported, and you will not be eligible to study allowance from CSN. Registration is possible only after you have applied and been admitted to the course. Program students who have not applied 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.

DISABLED STUDENTS (FUNKA)

If you have a disability and need special facilities or support measures to follow this course, please contact the “Funka” coordinators:

<https://www.kth.se/en/student/studentliv/studentratt/stod-for-studenter-med-funktionsnedsattning-1.324605>

It is important that you immediately, no later than the beginning of the course, contact the course coordinator and provide information and, if necessary a certificate from KTH Funka coordinators. This must be done in order for us to take into account your specific needs.

LECTURES (L1 – L9)

The lectures give theoretical coverage of LCA methodology. This is important for you to work efficiently in your projects. To get you started at an early stage, most lectures are given at the beginning of the course.

In the following, it is indicated what parts of the course literature relates to the topic of each lecture. Use this as a help to read ahead and to find the right literature when working on your projects. You are encouraged to do the exercises in the course book.

L1 - What is LCA? & Practical issues

The lecture introduces key features of LCA. The purpose is to give you 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 (2013) *SimaPro Introduction to LCA*. Chapter 1.

L2 – Forming project groups & Goal definition and scoping

First 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).

Second hour: We will discuss project ideas and form project groups (4 members per group). Please prepare before Lecture 2 by trying to think of areas and topics that you would like to work with in your projects.

<p>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!!!</p>
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Literature for L2:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 2.
- PRé Consultants (2013) *SimaPro Introduction to LCA*. Chapter 2.
- “Suggested topics for LCA projects in AG2800”(found in Bilda)

L3 - Goal definition and scoping continued

Goal definition and scoping continued.

Literature for L3:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 2.
- PRé Consultants (2013) *SimaPro Introduction to LCA*. Chapter 2.
- 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.
- Hauschild, M., Goedkoop, M., Guinée, J., Heijungs, R., Huijbregts, M., Jolliet, O., Margni, M., De Schryver, A., Humbert, S., Laurent, A., Sala, S., and Pant, R. (2013) Identifying best existing practice for characterization modeling in life cycle impact assessment. *International Journal of Life Cycle Assessment*, 18:683–697.

L4 - Inventory analysis

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 help you start collecting relevant data. This is necessary as background for the second project supervision meeting (PS2).

Literature for L4:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 3.
- PRé Consultants (2013) *SimaPro 7 Introduction to LCA*, 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.
- Hauschild, M., Goedkoop, M., Guinée, J., Heijungs, R., Huijbregts, M., Jolliet, O., Margni, M., De Schryver, A., Humbert, S., Laurent, A., Sala, S., and Pant, R. (2013) Identifying best existing practice for characterization modeling in life cycle impact assessment. *International Journal of Life Cycle Assessment*, 18:683–697.

L5 – Impact assessment

Describing the principles and methods available 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 third project supervision meeting (PS3).

Literature for L5:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 4.
- PRÉ Consultants (2013) *SimaPro 7 Introduction to LCA*. 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.
- Hauschild, M., Goedkoop, M., Guinée, J., Heijungs, R., Huijbregts, M., Jolliet, O., Margni, M., De Schryver, A., Humbert, S., Laurent, A., Sala, S., and Pant, R. (2013) Identifying best existing practice for characterization modeling in life cycle impact assessment. *International Journal of Life Cycle Assessment*, 18:683–697.

L6 – Weighting, normalisation and interpretation

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

Literature for L6:

- Curran, M. A. (2015) *Life Cycle Assessment Student Handbook*. Chapter 5.
- PRÉ Consultants (2008) *SimaPro 7 Introduction to LCA*. 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 – Social LCA

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

Literature for L7:

- 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 8 – LCA in practice

Lectures by invited speakers on the use of LCA for environmental product declarations.

- “The international EPD system – a tool for communicating life cycle performance of products and services”, Joakim Thornéus, The International EPD® System.
- “Environmental product declarations of buildings”, Nicklas Magnusson, Tyréns.

Lecture 9 – LCA in practice

Lectures by invited speakers on application of LCA in companies and for planning purposes.

- “LCA and eco design at Bombardier” Yannis Wikström, Bombardier.
- “Practical application of LCA in research: assessment of emerging technologies” James Joyce, KTH.

COMPUTER EXERCISES (C1 – C6)

We meet at six occasions in the computer lab. Teachers are present at these time to help you out. Of course, you also need to work on your own at other times in the computer lab with these exercises and your projects.

Learning to use SimaPro early on in the course is important to be able to complete a successful project. Attending computer exercises is well-invested time for you and your group! Attendance at five (5) computer labs is required.

Throughout the course, SimaPro will be available to you in three of the computers labs at KTH (Bure, MacLean and Faggott).

C1 – SimaPro demo and tutorial

Work in pairs, with someone in your project group. Run the SimaPro demo and start working on the tutorial. Follow the instructions that you can download from Bilda.

Literature for C1 (available in Bilda):

- *Instructions to SimaPro demo in AG2800*
- PRé Consultants (2013) *SimaPro Introduction to LCA*
- PRé Consultants (2014) *SimaPro Tutorial*

C2 – Tutorial and exercises

Work in pairs (same as C1). Continue working on the tutorial and do the exercises found in the instructions on Bilda.

Literature for C1 (available in Bilda):

- *Instructions to SimaPro demo in AG2800*
- PRé Consultants (2013) *SimaPro Introduction to LCA*
- PRé Consultants (2014) *SimaPro Tutorial*

C3 – C6 Own project modelling in SimaPro

Work in project groups. The remaining C3-C6 are scheduled to make sure you have time to meet a teacher to ask questions about modelling in SimaPro. However, 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 excercises

Minimum attendance at 5 (out of 6) computer exercises is required. Don't forget to sign the attendance list!

WRITTEN EXAM

A written home-exam is given at mid-term. The objective of this exam is to ensure that all students grasp what is necessary to actively contribute to the group projects.

Please check “Submission 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, including basic LCA theory and some minor calculation assignments. Make sure to study the literature along with the lectures, in advance to working on the home exam!

Instructions

- You can work on the exam anytime while it is open in Bilda.
- Answers are submitted by uploading your answers in Bilda (Assignments/Home exam).
- 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 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

You will perform an LCA using the software SimaPro. 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 a state-of-the-art LCA software.

Select topics and form project groups

LCA can be applied to assess life cycle environmental impacts of products, processes or service systems, for a range of different purposes. Students select their own project topics depending on their own area of expertise and interest.

Projects are performed in groups of 4 students. During Lecture 2, we will discuss what topics you are all interested in and help you to form groups. During supervision, we will then help groups to delimit the question to something which is meaningful and manageable within the scope of the project.

Please prepare before Lecture 2 by trying to think of areas and topics that you would like to work with in your projects.

Project supervision (PS) meetings

You will meet with a teacher four times throughout the course for project supervision (PS) meetings.

- **Sign up for supervision:** Your supervisor will provide a list to sign up for supervision. The schedule has given time slots for supervision, but a few other times will also be available for groups that have difficulty to find times that work for the entire project group.
- **How to prepare:** Details on what to prepare before meetings are listed in “*Instructions for project meetings in AG2800*”. It is important that you come well prepared, according to these instructions.
- **At the supervision meeting:** Each group member must act as “project coordinator” at one meeting, with responsibility to present the work of the group to that date, questions, or any other issues. By rotating this responsibility among the members of the group, we make sure that all group members share the responsibility of the project as evenly as possible.
- **Attendance:** The entire group is required to attend each meeting!
- A professional attitude, ie. 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

Each group has a project Log book in Bilda (Communication/Log book).

Before each supervision meeting, short notes must be prepared according to the instructions in "*Instructions for project meetings in AG2800*", uploaded to the Log book in Bilda, and brought on a paper copy to the meeting.

This will help you to plan and follow up your own work, it gives your teacher insight in the progress of your project, and provides a possibility for back-tracking events if problems arise.

Course requirement – Project log book

Before each supervision meeting, each group should update their log book and upload on Bilda. 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 report & critical review 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 during the pre-seminar. 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 a brief summary of their feedback and a reflection about possible improvements in their own project as a result of what they learned from other groups during the seminar.

Before the pre-seminar

- Sign up for pre-seminar times at lists passed around during computer exercise.
- You must attend the entire pre-seminar when your project is presented.
- You do NOT need to submit a draft report before the pre-seminar.
- Prepare a 10 min presentation that you can re-use and develop further for the final seminar. The presentation should only cover:
 - Goal & scope,
 - Life cycle inventory analysis, and
 - Brief outline of expected results and interpretation.

During the pre-seminar

- Bring your slides on a USB memory stick or own laptop.
- All group members must participate in the presentation.
- Outline of presentation (20 min per group):
 - 10 min presentation by project group
 - 10 min discussion. Discussion starts by responsible peer feedback group giving feedback and asking questions. After this, all attending groups can ask questions.
- 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.

After the pre-seminar: Written summary and reflection

After the pre-seminar, each peer-feedback group writes a summary and reflection (about 1 page) including the following:

1. Mention two things (at least) about the project that was particularly good/inspiring/creative.
2. Suggest two things (at least) that could be improved in the project.
3. Mention two things (at least) that you will improve in your own project, as a result of what you learned from others during the pre-seminar.

Upload in Bilda (Assignments/Pre-seminar reflection) after the pre-seminar. Please check “Submission deadlines” above in this document. Afterwards, these will be posted on Bilda 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 summary and reflection document of the pre-seminar, and upload it in Bilda according to instructions.

FINAL SEMINAR AND REPORT SUBMISSION

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

The report that you submit before the final seminar is the one that is graded. After the seminar you will receive written feedback from your supervisor with a preliminary grade and necessary amendments. The preliminary grade will be your final grade if you manage to make the required amendments. Otherwise you may receive a lower grade.

Before the final seminar

- Submit your report in Bilda (Assignments/Report). Please check “Submission 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 group has 45 min at its disposal
 - 20 min presentation
 - 15 min critical review
 - 10 min comments and questions from the rest of the audience
- All group members must participate and be able to answer questions related to the entire project.
- Bring your slides on a USB memory stick, or your laptop.

After the final seminar

- After the seminar you will receive written feedback from your supervisor with a preliminary grade and necessary amendments.
- Make revisions to final report, as required in written feedback from your supervisor.
- Final revised reports shall be handed in at Bilda (Assignments/Final revised report).
- Please check “Submission 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.

CRITICAL REVIEW OF PROJECTS

Each project group shall prepare a critical review of the project report of another group. Critical review is an important procedure for quality assurance of LCA. By reading thoroughly the report of another group and making a critical review, you will also gain deeper insights in LCA methodology and application.

Instructions

- When reports have been submitted, the reports will be uploaded in Bilda/Documents/Draft reports. You will be informed about what report to review, and you should download it from Bilda.
- The review should be prepared and presented according to the instructions in “*Instructions for report and critical review in AG2800*”.
- Submit your critical review in Bilda (Assignments/Critical review). Please check “Submission deadlines” above in this document.
- Also bring a paper copy of the critical review to the final seminar, to give to the group that you are reviewing.

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. Hand in according to instructions.

CO-OPERATION AND EQUAL CONTRIBUTION TO PROJECTS

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

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.

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 hp), grade scale: A, B, C, D, E, FX, F

Critical review (1 hp), grade scale: P, F

The final grade (A-F) is a weighted average of the written exam and the group project assignment. 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. Failing to meet other course requirements, deadlines etc. is considered a badly handled working process and will affect your grade negatively.

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

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

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)

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 project assignment is the most important part of this course. It is graded A-F (see grading criteria below). The grade of the project assignment is based on the following factors:

- The written report, considering its:
 - *content* (your understanding of LCA methodology, and ability to design and perform an LCA study)
 - *formal qualities* (outline, clarity, language, referencing).
- The group and individual student's performance at supervision meetings and at the final seminar.
- Fulfillment of course requirements, regarding e.g. attendance.

The written report is the most important aspect.

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.

KTH-ID AND ACCESS CARD

Access to SimaPro, Bilda, and KTH Social

To have access to SimaPro and Bilda you will need a kth.se account. If you do not already have one, instructions are available at:

<https://www.kth.se/en/student/kth-it-support/kth-account/ditt-kth-se-konto-1.533457>

Access card

You will need an access card to get into computer labs. If you do not already have one, pick up your access card at the IT-SupportCenter:

<https://www.kth.se/student/kth-it-support/on-campus/access-card/access-cards-for-campus-valhallavagen-1.516976>

HOW TO USE BILDA AND KTH SOCIAL

All registered students have access to Bilda and KTH Social, KTH's web-based tools for netbased learning.

At KTH Social (<https://www.kth.se/social/>) there is a course page with link to the schedule, important dates, and course plan.

We use Bilda (<http://bilda.kth.se>) for course material, management of project groups, and submission of exam and reports. We also communicate with students by sending messages through Bilda.

IMPORTANT!!!

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

We appreciate if you add a picture of yourself to your Bilda account!

The Bilda page includes the following:

Overview

An overview of all functions available to students in Bilda in this course.

Documents

Event documents

Students can download documents from here. It includes course material (course memo, instructions, lecture notes, scientific papers etc.) that are either posted from the start of the course, or will be posted by your teachers as the course proceeds.

My documents

Here you may upload personal documents. They are only visible and available to you.

Group documents

Each project group will have access to a group folder of their own, that is only visible and available to the members of that group.

Assignments

This is where you hand in answers to the mid-term exam, reports before the final seminar, final revised report after the final seminar, and your critical review.

Participants

A list of all participants and their email addresses.

Message board

Teachers can post messages to the entire course, or to selected project groups. The Home exam will be posted as a message, available from Nov 19.

Discussion

- A discussion forum is available for the entire course (Course café). This is where you ask questions to all other students of the LCA course, or tell everyone about remarkable LCA experiences that you have made!
- A special discussion forum will be open during the home exam, to pose questions to your teachers.
- A discussion forum is also available for every project group. Only members of that group have access to these forums.

Project groups

A project group account is set up for all groups. From here, you can view everything that your group has access to in Bilda.

LITERATURE

All course material, except the course book, can be downloaded from the course site in Bilda (<http://bild.kth.se>).

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

- 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.
- Hauschild, M., Goedkoop, M., Guinée, J., Heijungs, R., Huijbregts, M., Jolliet, O., Margni, M., De Schryver, A., Humbert, S., Laurent, A., Sala, S., and Pant, R. (2013) Identifying best existing practice for characterization modeling in life cycle impact assessment. *International Journal of Life Cycle Assessment*, 18:683–697.
- Hellweg, S. and i Canals, L. M. (2014) Emerging approaches, challenges and opportunities in life cycle assessment. *Science*, 344, 1109-1113.
- Wu, R. Yang, D., and ChenWu, J. (2014) Social Life Cycle Assessment Revisited. *Sustainability*, 6, 4200-4226.

SimaPro manuals

- PRé Consultants (2013) *Introduction to LCA*
- PRé Consultants (2014) *SimaPro Tutorial*

Other

- *Examples of topics for LCA projects in AG2800*
- *Instructions for project meetings in AG2800*
- *List of usefull LCA data sources in AG2800*
- *Instructions for report & critical review in AG2800*
- *Instructions to SimaPro demo in AG2800*