# Course PM for ML2308

*CDIO Course in Sustainable Production Development 15.0 credits*

## Course content and learning outcomes

### Course content

This course is based on the generic curriculum and the methodology for CDIO (Conceiving, Designing, Implementing, and Operating). That includes a set of activities to methodologically analyze and develop solution proposals in teams, in one of the sub-areas of sustainable production development. This can concern industrial design, analysis, optimization, choice of material, manufacturing and operation of different technical systems or products in the area of sustainable production development.

The most important results will be a written report and an oral presentation. Relevant and valid results in the work require use of knowledge in different sub-domains that have been covered by previously completed courses, and additional reading and industrial experience when necessary. The student develops proficiencies in the process of generating new knowledge, based on established theories and methods. The results of the CDIO work must have relevance for industrial application in addition to the academic contribution.

The course contains seminars to develop the CDIO work. The continuous discussion about the work with supervisors and in seminars is an important part of the course.

### Intended learning outcomes

The learning outcomes of the course include seven ILOs. After the completion of the course the student should be able to:

**ILO 1** - Demonstrate ability to master the entire development process designing - analyzing - testing - evaluating to methodically develop solution proposals for a complex problem in the field of sustainable production development.

**ILO 2** - Have knowledge of established design methods and tools, in order to identify areas for improvement of new or existing solution for a complex problem in the area of sustainable production development.

**ILO 3** - Demonstrate the ability to plan and execute a project in a group and, using appropriate methods, perform advanced tasks within a certain time frame, and evaluate this work.

**ILO 4** - Demonstrate the ability, both orally and in writing and in dialogue with different groups, to clearly explain and discuss their experiments, conclusions and the knowledge and arguments on which they are based.

**ILO 5** - Have knowledge and ability to show how the developed solution can be implemented and operated in an industrial production and logistics context

**ILO 6** - Demonstrate ability to make judgments with regard to relevant social, socio-economic and ethical aspects, both from a local and global perspective

**ILO 7** - Demonstrate the skills required to participate in development work as well as the implementation and operation of the developed solution, to be able to work independently in advanced industrial operations.

## Language of Instruction

English - knowledge of Swedish is not required, teaching language, course information and examination are in English; Swedish terminology can, however, be included in the course,

## Detailed Schedule

The course involves three types of activities: lectures, supervisions for student project, and evaluations. A specification of on-site or online activities, their relation to the course ILOS follows. On-site moments are marked yellow in the table below

| Date | Time | Themes | ILO |
|------|------|--------|-----|
| 2021-08-31 | 08:00 | Course Introduction and project planning | ILO 3 |
| 2021-09-02 | 09:00 | Company presentations | |
| 2021-09-14 | 08:00 | Product design lab & Sustainability workshop | ILO 6 |
| 2021-09-16 | 08:00 | Visualization, engineering requirements, and intangible assets | ILO 4 |
| 2021-09-21 | 08:00 | Supervision & Sustainability workshop | |
| 2021-09-22 | 08:00 | Lean leardership | ILO 3 |
| 2021-10-05 | 08:00 | Student sales pitch to external committee and sustainability workshop | ILO 6 |
| 2021-11-04 | 08:00 | Students: Working successfully in organizations (Student) | ILO 7 |
| 2021-11-10 | 08:00 | Supervision | |
| 2021-11-16 | 08:00 | Student presentation | ILO 1 |
| 2021-11-23 | 08:00 | Student presentation | ILO 2 |
| 2021-11-30 | 08:00 | Student presentation | ILO 5 |
| 2021-12-07 | 08:00 | Supervision | |
| 2021-12-15 | 08:00 | Final Presentation | |

### Supervisions

Supervisions are self-directed. Students will steer the content of the supervision. There are four supervision moments scheduled in ML2308. Therefore students interested in receiving feedback during supervision should:

- Clearly define the problem, topic, or question and relation to ILO they wish to discuss prior to the supervision

- Upload files a week before the supervision

- Attend supervision at the appointed time and date

Important: Students that do not comply with the above but attend the supervision may participate in the discussion but will not receive feedback to their work.

### PRO1 October 5
In this occasion you will have the opportunity to present your progress, plan, vision of solution, expected results, etc. to industry representatives who will provide feedback on your work. Make sure to upload material in Canvas on October 5, 2021 by 08.00 am

### Specific Prerequisites
Completed courses:
ML2300 Sustainable production, ML2301 Production management and development, ML2305 Production logistics and supply chains, and ML2306 Industrial analytics for advanced manufacturing, or the equivalent courses.

# Examination and completion

## Grading Scale

A, B, C, D, E, FX, F

## Examination

- PRO1 – Project, 15.0 credits, grading scale: A, B, C, D, E, FX, F

PRO1 includes project work at a company. Therefore, you are expected to work with a CDIO development project in parallel with course work. PRO 1 is assessed based on four assessments including a report, presentation, video, and prototype of the student project.

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

## Other requirements for final grade

Completion of seminars or other activities that have been established by supervisor/examiner as milestones for progress in the project work.

## Examinator

Jannicke Baalsrud Hauge <jmbh@kth.se>

## Ethical approach

- All members of a group are responsible for the group's work
- In any assessment, every student shall honestly disclose any help received and sources used
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution

## Goal related grading criteria

PRO1 is examined based on four assessments including a report, presentation, video, and prototype of the student project.

| Learning outcomes | PRO1 | | | |
| --- | --- | --- | --- | --- |
| | Report | Presentation | Prototype | Video |
| **ILO 1** - Demonstrate ability to master the entire development process designing - analyzing - testing - evaluating to methodically develop solution proposals for a complex problem in the field of sustainable production development | x | | | |
| **ILO2** - Have knowledge of established design methods and tools, in order to identify areas for improvement of new or existing solution for a complex problem in the area of sustainable production development. | | x | | |
| **ILO3** - Demonstrate the ability to plan and execute a project in a group and, using appropriate methods, perform advanced tasks within a certain time frame, and evaluate this work. | | | x | |
| **ILO 4** - Demonstrate the ability, both orally and in writing and in dialogue with different groups, to clearly explain and discuss their experiments, conclusions and the knowledge and arguments on which they are based. | x | x | | |
| **ILO 5** - Have knowledge and ability to show how the developed solution can be implemented and operated in an industrial production and logistics context | | | x | |
| **ILO 6** - Demonstrate ability to make judgments with regard to relevant social, socio-economic and ethical aspects, both from a local and global perspective | x | | x | x |
| **ILO 7** - Demonstrate the skills required to participate in development work as well as the implementation and operation of the developed solution, to be able to work independently in advanced industrial operations. | x | | | |

## Examination of ILOs and grading criteria is as follows:

| | A | B | C | D | E |
| --- | --- | --- | --- | --- | --- |
| **ILO 1** | Apply a methodological approach to scientifically correctly analyze, abstract, develop and evaluate solutions that can possibly be implemented to solve a complex problem based on limited information, but from a holistic perspective. | More than C but not A | To a large extent, methodical progress is made to analyze, abstract, develop and evaluate solutions that can possibly be implemented to help solve a given complex problem from a holistic perspective. | More than E but not C | Apply given methods to analyze, abstract, develop and evaluate a solution that can help solve a well-defined complex problem from multiple perspectives. |
| **ILO2** | Based on very good knowledge of established design methods and tools, select and apply adequate tools to identify possible improvements to a new or existing solution, all with a distinct holistic, critical and systematic approach | More than C but not A | On the basis of good knowledge of established design methods and tools, select and apply adequate tools to identify possible improvements to a new or existing solution, from multiple perspectives. | More than E but not C | Based on basic knowledge of established design methods and tools, apply tools to identify possible improvements, from multiple perspectives. |

| | | | | | |
|---|---|---|---|---|---|
| **ILO3** | Apply methods for effective project planning, implementation and monitoring and be able to handle deviations and disruptions. In addition, direct the project based on a definition of the interfaces between the various tasks and responsibilities, and to develop and use communication strategies that ensure | More than E but not C | Apply methods for effective project planning, implementation and monitoring and be able to handle deviations and disruptions. In addition, use communication strategies that ensure a good collaboration climate. | More than E but not C | Apply methods for project planning, implementation and follow-up and be able to handle deviations and disruptions. |
| **ILO 4** | Clear and structured written and orally presented approach, method and development process. In addition, a demonstrated ability to discuss the advantages and disadvantages of the developed solution for a knowledgeable audience, and to present the solution contribution in a popular scientific way to an uninitiated audience. | More than E but not C | Clear and structured written and orally presented approach, method and development process. In addition, a demonstrated ability to discuss the pros and cons of the developed solution for a knowledgeable audience, | More than E but not C | Clear and structured written and orally presented approach, method and development process |
| **ILO 5** | Implement and deploy (for a shorter period) a prototype that satisfies all requirements specifications, or justify why not all specifications can be met in a technically and socially financially satisfactory way. | More than E but not C | Implement and deploy a prototype that satisfies the requirements specification in terms of main functionality and safety-relevant requirements. | More than E but not C | Implement a mock-up that demonstrates how a stable prototype can work and meet the most important requirements specifications. |
| **ILO 6** | Choose and apply established methods to evaluate social, socio-economic and ethical aspects related to the implemented prototype and discuss the various implications it has in the three areas. | More than E but not C | Selecting and applying established methods to evaluate social, socio-economic and ethical aspects related to the implemented prototype. | More than E but not C | Applying established methods to evaluate social, socio-economic and ethical aspects of a conceptual prototype (so-called mock-up) |
| **ILO 7** | Choosing and applying established methods to evaluate the market, market risks and opportunities. Make cost estimates and calculate relevant KPIs, taking into account market uncertainty. Perform investigations that can lead to patent opportunities and IPR | More than E but not C | Choosing and applying established methods to evaluate the market, market risks and opportunities. Make cost estimates and calculate relevant KPIs. | More than E but not C | Apply an established method for market valuation and risk assessment. Make cost estimates |

## Examination Details

For a passing grade in the course approving PRO1 is required. To be approved in PRO1, attendance at study visits, presentation and approved report is required. The final grade is an average of the grades of the respective ILO above (with at least E on all). The ILOs and each assessment (Report, Presentation, Video, and Prototype) are scored using a scale 0-3. Each assessment (Report, Presentation, Video, and Prototype) is considered a pass if the ILOs assessed in that occasion are at least 1 equal to E. Grades are assigned based on the intervals (inclusive) where cumulative scores lay as shown in Table 1.

Table 1 – Grading scale including maximum and minimum intervals

| Grade | Maximum | Minimum |
|---|---|---|
| A | 3 | 2,71 |
| B | 2,7 | 2,35 |
| C | 2,34 | 1,71 |
| D | 1,7 | 1,25 |
| E* | 1,24 | 1 |
| * Each ILO should be scored as 1 to obtain an E grade. | | |

Fx or F in one of the assessments will be taken as it is for the whole course despite a passing grade on the other assessment type.

## Examination Delivery and Due Dates

### Report
Deadline for the written report is **December 15, 2021 at 08.00**. Delivery of report is on Canvas.

### Presentation
Delivery of presentation depends on the assigned topic. Presentation will be submitted on Canvas. The topics will be assigned after the start of the course and each group will be responsible for a topic. The deadline for the presentations are the following:
- Group 1          **November 4, 2021 at 08.00**
- Group 2          **November 16, 2021 at 08.00**
- Group 3          **November 23, 2021 at 08.00**
- Group 4          **November 30, 2021 at 08.00**

Requirements for the presentation include
- 60 minute lecture on the assigned topic
- 30 minute active learning

### Prototype
Deadline for the prototype is **December 15, 2021 at 08.00** during final presentation.

### Video
Deadline for the video is **December 10, 2021 at 13.00.** Delivery of video is on Canvas.

## Important notification

This is a translation of the original text in Swedish. In case of further clarification on ILOs and Examination of ILOs and Grading Criteria please refer to the original text in Swedish.

# Teachers

**Course coordinator**
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