0.   **Author** (Name, email)

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1. **Description of the course evaluation process**
   Describe the course evaluation process. Describe how all students have been given the possibility to give their opinions on the course. Describe how aspects regarding gender, and disabled students are investigated.

The course FMG3920 started with eight students, but one of the students dropped out from the course due to some unrelated issues. Seven students remained until the end of the class. A questionnaire for the course was sent to all seven students regardless their gender and disability on 2021-06-21. Two weeks time was given to fill the questionnaire. All 7 people filled the questionnaire (100%). An evaluation report has been published on the course web under Administration / Course evaluations.

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2. **Description of meetings with students**
   Describe which meetings that has been arranged with students during the course and after its completion. (The outcomes of these meetings should be reported under 7, below.)

During the classes and visits, regular verbal feedback had asked from the students. Since this was a PhD course, the teachers were directly in contact with the students, and hence, informal regular feedbacks continued to be collected outside the classes as well.

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3. **Course design**
   Describe briefly the course design, the constructive alignment (intended learning objectives, learning activities, assessment, and how they interact), and the development that has been implemented since last course offering.

This course is to generate an interdisciplinary set of detailed and comprehensive know-how for PhD students from different backgrounds (production engineering, materials science, mechanical design, etc.) to fill the current knowledge gaps for metal AM adoption and exploitation. Different perspectives is presented based on different disciplines of teachers and researchers from departments at the school for industrial technology and management (ITM)/KTH Royal Institute of Technology and the unit for Solid Mechanics at the Department of engineering mechanics, the school for technological sciences (SCI)/KTH Royal Institute of Technology. The course also intends to increase the interaction between doctoral students with a focus on AM in different disciplines to strengthen the connections between the different departments and contribute to the interdisciplinary research in KTH Royal Institute of Technology.

The course content is delivered through a mix of lectures, discussions, tour to our AM facilities, and projects. On completion of the course, the student should be able to:
- summarise and explain the different additive manufacturing processes and describe limitations and possibilities with state-of-the-art 3D printers.
- give examples of process-structure-property relations for metallic materials produced using additive manufacturing.
- apply knowledge to anticipate mechanical properties on macro level.

- apply design criteria for components produced with additive manufacturing processes including cost aspects and sustainability.
- summarise questions relevant to additive manufacturing in different disciplines in addition to the student's own subject area.

Note: This was the first time that the course was given. Therefore, no changes was applicable from the last time.

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4. **Students' workload**

Are the students working to the expected extent in relation to the course credits? If there is a significant difference from the expected, what can be the reason?

Since the course was open to PhD students from different disciplines, there could be some differences in the workload due to the pre-knowledge in different topics (for example learning ANSYS for the project) that were addressed during the course. The feedback from 7 PhD students was 2 people 9-11 hrs/week, 3 people 6-8 hrs/week, and 2 people 3-5 hrs/week. This means 7 hrs/week in average. Since the course lasted from 19 Jan to the end of June, this course can be considered to be lasted around 23 weeks. This would result in 161 hrs, which is about 20% less than the 200 hrs of work anticipated for this course. Two possible reasons of less workload than the anticipated could be recognised: 1) the course is given to PhD students who would naturally need less effort to learn and ii) the course has been turned partially online this time due to the COVID 19, hence, the students might have felt less workload for their study and engagement. Therefore, we should carefully assess whether we have to increase the workload or not before imposing more workload.

Note: Most students pointed out that '*the workload is not very even, the first period is not very hard, but the last assignment is very intensive*'. This necessitates that we relook at the schedule of the course and try to reschedule the work to be more even. This could be by, for example, distributing the projects in an earlier time to allow more time to deliver the assignment.

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5. **Students' results on the course**

How have the students succeded in the course? If there is a significant difference compared to previous course offerenings, what can be the reason?

Minimum 80 percent of the lectures should be attended. To pass the course, it's obligatory to attend all the compulsory days, to deliver the project and to give a presentation and submit a report. The course will be graded on Pass or Fail basis.

Note: This was the first time that the course was given. Therefore, no changes was applicable from the last time.

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6. **Students' answers to open questions**

What does students say in response to the open questions?

Best aspects:
- Good to get in touch with PhD students in a similar field as yourself.
- The best aspect was the assignment. But the lectures were also equally exciting and helpful
- Know knowledge from different perspectives of AM, meet other phd students
- The content is very comprehensive and interesting, the final task is very useful
- AM is discussed in regards to different fields.

- Digging into problems and presenting a general view at the same time. Clearly, a lot of time and thinking went in preparing the course from the organizers.

Things to improve:
- Not evenly distributed work load
- The project was very focused on only learning Ansys. It was a good and fun project, but maybe have some other assessments as well
- Instead of having one big lecture for 6hrs, it would be better to have two 3hrs lectures, especially if this course will be conducted only through zoom.
- Having a lab type of environment for learning the AM CFD software would ease the learning process and will also prevent the time wasted on small unimportant things that can take days to figure out
- Most of the lectures were on zoom, while zoom lectures were not very stimulating
- Add binder jetting
- If the same assignment is to be kept, this could be broken down into two parts: optimization, to be completed in an earlier stage, and then AM simulation

Advise to future participants:
- No particular advise. The course was very satisfactory in general.

7. Summary of students' opinions
Summarize the outcome of the questionnaire, as well as opinions emerging at meetings with students.

The course is generally interesting, enjoyable, stimulating, diverse, comprehensive and learning. The workload was unevenly distributed that should be tackled. This could be by giving the assignment earlier (and perhaps splitting it into two parts) and not at the end. Zoom lectures should be avoided when possible, as they are not very stimulating. New subjects such as binder jetting should be considered to be added.

8. Overall impression
Summarize the teachers' overall impressions of the course offering in relation to students' results and their evaluation of the course, as well as in relation to the changes implemented since last course offering.

The teachers seem to enjoy the course as much as PhD students. I personally preferred in person lectures, since I could fully exploit the attention and interaction of the students. Since the course was given for the first time, and the COVID situation had occurred, many experiences (e.g., teaching on zoom) were new for some of the teachers. However, the teachers were flexible and adjusted themselves when it was necessary. Next time, perhaps we can also involve the industrial partners in our lectures and/or add new related syllables to our lectures. The uneven workload should also be tackled. However, for the scheduling and particularly for in person classes, we should also consider that the students and industries may join this class from all over Sweden. In those cases, for practicality reasons, consolidated sessions in particular days (although they are heavy) and perhaps zoom/hybrid meeting may appear essential.

9. **Analysis**

    Is it possible to identify stronger and weaker areas in the learning environment based on the information you have gathered during the evaluation and analysis process? What can the reason for these be? Are there significant difference in experience between:
    - students identifying as female and male?
    - international and national students?
    - students with or without disabilities?

Stronger areas: Diverse teachers/information/knowledge, interesting issues, comprehensive/useful knowledge on the related concepts, motivating/interesting assessment, and bringing AM related PhD students from different departments together.

Weaker points: Uneven workload, long lecture days (which could be necessary if the students are from outside Stockholm in future), holding many meetings on zoom compared to in person lectures (which could be necessary in some cases such as COVID, industrial attendance, and international presenters).

As a strength, no clear differences in experience between female/male, international/national, and with/without disabilities students were visible.

10. **Prioritized course development**

    What aspects of the course should be developed primaily? How can these aspects be developed in short and long term?

The course should be rescheduled to make the workload even in short term. The assignment could be diversified and other related subjects could be added to the syllables in long term.

11. **Other information you want to share**

We would like to add this course to Production 2030 in order to make it available for all PhD students in Sweden.