

THE NEEDS OF NTNU FROM INDUSTRIAL PARTNERS IN NTNU MIKROELEKTRONIKKFORUM FOR MASTER EDUCATION

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This document outlines wishes from NTNU for the outcome of cooperation with industrial partners in NTNU Mikroelektronikkforum (MEF).

1. WHO

The audience is industrial partners and faculty staff at NTNU.

2. WHY

MEF is to be a lightweight forum for cooperation between the micro-electronics industry in Norway and the faculty members at Department of Electronic Systems, NTNU, working in the same field. This document is meant to be part of the basis for a discussion on activities to be organized in the forum, but even more on how the industry and NTNU can cooperate to ensure that the education given, and research performed at NTNU are aligned with the needs from industry.

More specifically, the document outlines what NTNU would like as outcome of the cooperation, on course development and implementation, on student project and master thesis, and on research in micro-electronics and related fields of study.

3. COURSE DEVELOPMENT AND IMPLEMENTATION

Our students, mainly in the MTELSYS (five-year master), MSELAYS (two year international master), and MSECS (two year European master) programs, can choose among a large number of course. MTELSYS starts with three years of compulsory courses giving a basis for further studies. Among the most relevant for MEF are *Introduction to analog and digital electronics* (first year) and *Design of integrated circuits* (third year), both containing a mix of analog and digital design. Students in MSELAYS and MSECS specializing in *Digital systems design* or *Analog circuit design* also take *Design of integrated circuits*. On top of this they all can choose *Design of digital systems 1*, *Design of digital systems 2*, *Analog CMOS 1*, and *Advanced integrated circuits*. Depending on specialization and choice of autumn project and master thesis topic in their final year, they choose two between a number of specialization topics, e.g., *Low-power design*, *Hardware/Software Codesign of Embedded systems*, and *Analog CMOS 2*. The students naturally have a large set of courses in addition to these, but these are the once where it is most natural to include topics specifically relevant for the micro-electronics industry.

NTNU would like MEF members to take part in discussions related to the topics covered in these courses. NTNU has to consider the needs of the wider Norwegian industry as well as research organizations, academia, and the public sector, but MEF has a very relevant set of members for such

discussions. Feedback on the knowledge of newly hired employees educated from NTNU will help us improve our courses. Similarly, suggestions for topics that is seen to be relevant in the future, will be very useful. At MEF meetings NTNU can present both the overall course organization and structure and details on selected courses, followed by discussions among members giving input to possible improvements.

MEF members can also contribute with guest lectures in these courses, on topics close to their expertise. This both gives a better presentation of relevant topics and motivates students when they see the relevance to future jobs.

Finally, we also see examples of employees at companies having adjunct (20%) positions at NTNU, contributing to teaching and research.

4. STUDENT PROJECT AND MASTER THESIS WORK

In their final year, our students have a project, typically one quarter of the autumn semester load (MSELAYS and MSECS) or half the autumn semester load (MTELSYS and some MSELAYS and MSECS students). Most students with specializations in the fields of micro-electronics take projects suggested and co-supervised by companies. This ensures that the students work on relevant topics and shares the workload of supervision. It naturally also sets the companies in contact with possible future employees. For this to work, we need a sufficiently large number of project assignment suggestions from companies, as well as supervision time and technical support from employees in companies. The companies also need to understand the special nature of these assignments, being first and foremost an academic and educational task. The assignments should hence be aligned with, but not directly required for, the products and development performed in the companies. The same holds for master thesis work.

After the final submission of a master thesis by a student, the thesis is graded by a committee consisting of an external member from outside NTNU and one internal NTNU member that has not been involved with the thesis supervision. NTNU would very much like to have a pool of employees from companies that can participate in these committee.

Together, NTNU and MEF members can agree on good procedures for suggesting assignments as well as for the supervision and grading work.

Finally, MEF can be the sponsor of the Mikroelektronikkprisen, given to the best master thesis in the field of micro-electronics each year. This sponsorship will both depend on the MEF membership fee and on committee

time deciding on each year's winner among nominated candidates.

The award winner is invited to write an article about the thesis in the trade magazine Elektronikk. Sometimes, master students also writes papers about their work to be presented at conferences and in academic journals. A part of the MEF membership fee will be placed in a fund to support the cost of such publishing. Support from this fund is not limited to the award winner. All students with a thesis in micro-electronics, and who has a paper based on the thesis accepted at a conference or in a journal, can apply to the MEF board for support.

5. RESEARCH

The department on a regular basis applies for and, when accepted, carries out research projects finance by, e.g., the Norwegian Research Council (NFR) and the EU. These can be fundamental or applied research projects. Some are directly relevant for future developments in micro-electronics, while others use micro-electronics as an enabling technology to solve other challenges. In all cases, it is essential to have cooperating partners, both as problem and application owners and contributing with time and resources in the projects.

MEF can be a discussion partner to make the proposals relevant and successful, and member companies can be project consortium members or advisory board members. Finally, NFR opens for industrial PhD agreements, where employees take a PhD with shared financing between the employer and NFR (50% each). If done correctly, this can be very beneficial for both company, candidate and NTNU.