Examination for DEIS

This document seeks to explain what a student needs to do to or does not need to do to earn a certain grade.

Grading criteria have been chosen to be aligned with the intended *learning outcomes* and learning activities of the course, as have been described in the Introduction.

In short the student is expected to engage in *applying basic knowledge in DEIS while collaborating* (the basic requirement), *hypothesizing independently* (creativity), *and reflecting* (excellence of methodology), in collaborating on a problem-solving project and during lectures and labs (half the grade will come from the tollgates including a written report about the project; half the grade will come from the oral exam).

Based on these intended learning outcomes, grading criteria are as follows.

Simply and informally, a failing mark will be given if a student has not fulfilled the basic requirement for applying knowledge or sought to hypothesize and reflect to a basic degree.

Also note that **we expect all labs/reports/code to be completely original (it is not okay to turn in a lab report with unreferenced material from others/work done by students from previous years).**

A grade of 3 will be given if a student has achieved the first learning outcome, and fulfilled the other two to a basic degree. A grade of 4 will be given if a student has completed the first two learning outcomes to a high degree and the third to a basic degree (thus fulfilling basic requirements and demonstrating *creativity)*. A grade of 5 will be given if a student has achieved all three learning outcomes to a high level, fulfilling basic requirements, demonstrating creativity, and furthermore showing a deep understanding of *excellent methodology* reflecting the literature and their own experiences.

The grading criteria are described in detail below:

Fail: The student has not fulfilled one or more basic requirements for the course.
- The student has not shown evidence of applying basic skills and knowledge related to DEIS in collaboration with peers by meeting the tollgate requirements[1,2]--presenting a design, demonstrating and discussing their work in front of the examiner and all groups, and submitting required materials (a final report with images, commented software with any data which might be relevant, presentation slides, and their robots)[3]-- and submitted all labs (successfully completing most); OR
- The student has not shown evidence of hypothesizing to a basic degree about some work which could be done in their speciality (e.g., embedded, intelligent, or communication) and specific steps required to accomplish it by: building a capability for their robot and describing the logical reasoning for their choice in their final reports and when asked by the examiner; OR
- The student has not shown evidence of reflecting to a basic degree on their experiences above in terms of the advantages and disadvantages of various approaches and explaining how simplified embedded and intelligent systems work as a whole: in their final reports and when asked by the examiner; OR
- There is some evidence of plagiarism or other academic dishonesty.

1 The tollgates are described in detail in the project description.
2 It is possible to miss examination events (e.g., due to illness with doctor's certificate, or death of a family member). Reexamination chances will be given three times a year (however students do not have the right to come back after a long absence: e.g., five years).
3 Each student does not need to submit a final report, code, and slides themselves. If possible the student's group should submit one final report. If not possible the student should submit their own

report with an argument for why they were not able to do so, and evidence that they have collaborated with peers.

Grade 3: The student has fulfilled the basic requirements for the course, in applying basic skills and knowledge in DEIS in collaboration with others.
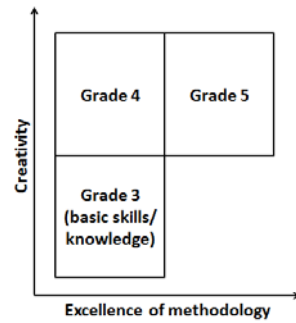
- The student, as part of their group, has delivered all required materials describing the student's learning/problem-solving experiences applying and collaborating, as also detailed in the exam event descriptions below: a final report with images, commented software with any data which might be relevant, presentation slides, and their robot, for each group; also the student has submitted all labs and passed most.
- The student has freely thought up one challenge in their speciality (embedded, intelligent, or communication) and solved it for their robot.
- The student can reflect on their experiences and explain and show how the system works as a whole, in an acceptable way, in their report and when asked by the examiner.

Grade 4: In addition to the requirements above, the student has demonstrated the ability to think creatively on their own.

- The student has shown creativity supported by a clear logical basis in applying and collaborating, in their project, report, and oral responses. ("Creative" here means they have engaged in relevant work which is not suggested by the teachers, not tackled by their fellow students, and possibly with little precedent in the literature. It does not mean "crazy", "random" or "incompatible" with the overall scenario; there must be a clear logical basis for decisions which the student should be able to explain, and it should not prevent the student's robot from cooperating with the other robots. Also creative work should not be entirely "trivial", like putting a sticker on their robot, but should involve some work to conduct).
- The student, also as part of their group, has been creative independently, actively engaging in a disciplined, self-managed way without requiring too much external help.
- The student can reflect creatively, proposing feasible strategies for improving a system accompanied by supporting logic when a solution may not be known, in their report and when asked by the examiner.

Grade 5: In addition, the student has demonstrated the ability to reflect and employ excellent methodology.

- The student has learned and applied excellent methodology in collaborating which can be expected to have a noticeable effect in the performance of their robot's motions (e.g., for position, speed, acceleration), the report and oral responses. ("Excellent methodology" means that techniques employed should be (scientifically) sound, and exhibit superior characteristics compared with other choices such as robustness, generality (applicable to many problems), appropriateness given the requirements, computational complexity, and technical challenge.)
- The student has demonstrated excellent methodology in their own work habits, e.g., with regard to being on time with their contribution to support their group members and robot to support other groups, and leadership in proposing and selecting good solutions for a shared scenario.
- The student can reflect based on an excellent knowledge of methodology which allows them to provide accurate relational explanations about the main accepted solution strategies and trade-offs for various typical problems related to the design of embedded and intelligent systems; a high degree of both pragmatic and conceptual knowledge acquired through active learning affords a deeper understanding of the area (a "helicopter" view).

The figure above illustrates the basic concept of the grading criteria.

In summary, the final grade given is weighted in relation to the quality of basic skills/knowledge, creativity and methodology demonstrated, by which we hope to motivate students to learn in a way which will lead to deeper knowledge and enable further learning and also research in the area of intelligent and embedded systems.

Please also see the grading sheet for the course, and additional important notes.