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# General Skills Courses at EECS

## Report from the PA Working Group

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**Summary.** We describe a framework for the creation and execution of general skills courses for the doctoral programs at EECS, in accordance with the goals and guidelines formulated by the Higher Education Ordinance and KTH. We define a number of requirements that this framework has to meet, and analyse our proposal against them. We advocate to keep the current structure of mandatory courses, but to define mechanisms for adding courses and modules to address new goals, and to allow students to take mandatory general skills courses from other programmes at EECS in certain situations. We propose to create and maintain a pool of courses, both at EECS and external, and a mechanism for securing their operation and funding from the budgets of the doctoral programmes.

## 1. Background

The EECS school encompasses 4 doctoral programmes: E2DOC, CS, ICT and MC (hosting roughly 250, 150, 90 and 30 registered students, respectively) across 3 former schools (EE, CSC and ICT). Prior to merging these schools, the programmes had their own sets of mandatory and general skills courses, and their own processes for creating and funding courses. These were functioning well, as attested by the evaluation by UKÄ of some subject areas (such as Computer Science) in the spring of 2017. In particular, the programmes differ significantly in their handling of the topic of *Research Methodology*, which has been individualised and fine-tuned to the needs and practices in the respective scientific areas.

The merger of the three schools into one school, however, has created certain opportunities to exploit potential **synergies** between the various programmes and to provide increased **efficiency** and **robustness**. This is particularly evident in the context of the so-called *general skills courses* (but in view of the increasing role of multidisciplinary research, it may in the future also concern specialised courses).

## 2. Our Mission

Our mission is to formulate a school-wide **process** for the creation and execution of general skills courses, which:

- 1) covers the **goals of third-cycle education (3CE)** as defined by the Higher Education Ordinance (Högskoleförordningen) and KTH, but also covers **additional goals** deemed to be useful for the education and professional preparation of our doctoral students;
  - 2) is **flexible** and **extensible**, allowing to accommodate new topics that need to be integrated into our third-cycle education, such as Sustainability and JML (Gender Equality, Diversity and Equal Opportunities), and allowing doctoral students to choose between courses deemed to be interchangeable by our programmes;
  - 3) is **sustainable**, by guaranteeing teachers availability and course funding;
  - 4) is **robust** to potential disruptions, by allowing students to be redirected to similar courses within the school in emergency cases;
  - 5) is **efficient**, by sharing common costs and avoiding unnecessary duplication of resource spending;
  - 6) is **well-documented**, by making the relevant information about the courses available and easy to find and navigate.
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Below we shall address these requirements in greater detail.

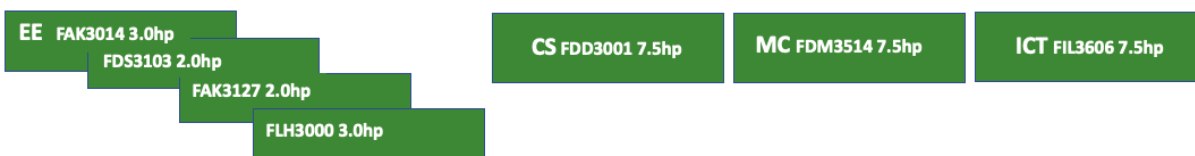
### 3. The Goals of 3CE and their Relation to Courses

In its appendix “*Bilaga 2. Examensordningen till högskoleförordningen*”, the Higher Education Ordinance (Högskoleförordningen) defines 10 **goals**, on top of which KTH adds one (on environmental, ethical and sustainability aspects of research). These goals are to be met with various activities, which are planned and accounted for in the doctoral students’ eISP’s.

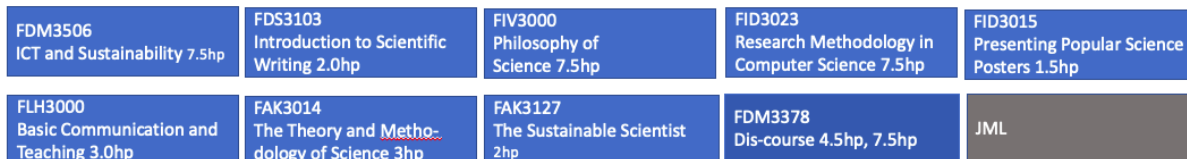
The recently distributed new ASP template suggests concrete **activities** for reaching each of the goals. These activities, formulated by KTH, include for some of the goals, examined and passed parts of **courses**. We take this description as a guideline for which goals are necessarily to be addressed by means of courses and which not. In principle, we do not consider courses in themselves as being sufficient for achieving any individual goal. However, courses can contribute to various degrees, as evident from the template. As stipulated in our current ASPs, it is a necessary requirement for each student to account, in their eISP, for the exact activities performed to address each of the goals, including the courses taken.

#### General skills courses EECS

##### Mandatory courses EECS



##### Recommended courses EECS



##### Elective courses EECS (Full list attached in appendix)

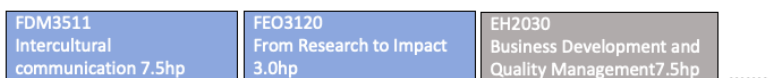


Figure 1. Mandatory, recommended and elective general skills courses at EECS.

In the context of the general skills courses, by **mandatory** and **recommended courses** we shall designate courses that address the 11 **main goals** (i.e., the goals stated by the Higher Education Ordinance and KTH). **Elective** courses address all other general skills that we think are important for a PhD student. A diagrammatic view of these courses is shown in Figure 1.

#### Mandatory General Skills Courses at EECS

Our 4 programmes have different sets of mandatory courses. In *Appendix B* below, we show which of the mandatory courses addresses which of the main goals. As can be seen from it, all goals that need to be examined by means of courses are already covered by each of the

programmes. The new topic of JML (Gender Equality, Diversity and Equal Opportunities) has still to be integrated, though (we describe below possible solutions). Our proposal is to keep the current structure of mandatory courses and build on it, by adapting it to the needs of the school. We do not consider it advisable at this point to either split the larger courses into smaller ones (since this might disrupt their current operation) or to merge similar courses from different programmes. We shall expand on this below.

There are good reasons for having different sets of mandatory courses. For example, while certain parts of the content of our respective *Research Theory and Method* courses could be argued to be similar, other parts are unique due to the specifics and traditions of the respective research area. Even those parts of the content that could be argued to be similar are in fact often applied in unique ways. Examples of this are statistical methods and analysis, methods for observation, usability methods, aspects of sustainability and ethics, etc.

### Elective General Skills Courses

Concerning the additional goals, we propose to create and maintain a pool of courses, both at EECS and external, and a process for securing their funding and operation. For instance, the E2DOC programme has several smaller mandatory courses, which will be offered as elective courses to the students from the other programmes. Here is a list of **existing general skills courses at EECS**:

<a href="#">FDH3377</a>	<a href="#">Dis-Course 4,5 hp</a>	4.5 hp	EECS
<a href="#">FDH3378</a>	<a href="#">Dis-Course</a>	7.5 hp	EECS
<a href="#">FDM3506</a>	<a href="#">ICT and Sustainability</a>	7.5 hp	EECS
<a href="#">FDM3511</a>	<a href="#">Intercultural Communication</a>	7.5 hp	EECS
<a href="#">FEO3120</a>	<a href="#">From Research to Impact</a>	3.0 hp	EECS
<a href="#">FID3015</a>	<a href="#">Presenting Popular Science Posters</a>	1.5 hp	EECS
<a href="#">FID3023</a>	<a href="#">Research Methodology in Computer Science</a>	7.5 hp	EECS

We have also discussed the possibility that a 3rd cycle *Project Management* course could be developed and offered by Joakim Lilliesköld, along the lines of his 2nd cycle courses:

<a href="#">EH2030</a>	<a href="#">Business Development and Quality Management</a>	7.5 hp	EECS
<a href="#">EH2070</a>	<a href="#">Project Management and Business Development</a>	6.0 hp	EECS
<a href="#">EH2720</a>	<a href="#">Management of Projects</a>	7.5 hp	EECS
<a href="#">EH2760</a>	<a href="#">Management of Projects</a>	6.0 hp	EECS

Furthermore, general skills courses addressing topics such as *Academic Writing, Inclusive Academy, Entrepreneurship, IPR, Project and Stress Management, Popularisation of Research / Outreach*, etc, are **given by other KTH schools**, and can also be suggested to the doctoral students of EECS programmes (see *Appendix A* for a longer list).

## 4. A Process for Course Creation and Operation

### Description of the Process

The **definition and establishment** of a new general skills course should stem from a direct need for such a course. and should be carried out in close connection with a suitable teacher as described above. For purposes of robustness, such courses should preferably be led by

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teachers who have a direct research association with the subject or have teaching within the subject as a main task. One should bear in mind that any change with respect to mandatory or strongly recommended courses has to be followed by corresponding a modification of the ASP. Therefore, new general skills courses will typically be offered as elective courses.

Regarding the **funding** of general skills courses, in the long run it is the doctoral programmes that should finance all mandatory and recommended courses from their budget. One solution is to associate, with each course, a fee per student, which is then to be covered by the programme to which the respective student belongs. Most likely, a limit for the number of students needs to be stated for each installment of each course, as a basis for calculating this fee.

### Information about Courses

One evident opportunity that arose when the schools merged was the possibility to offer courses from the different programmes to all PhD students at EECS. However, this requires that the pool of courses is **well-documented and clearly visible**, making the relevant information about the courses available and easy to find and navigate. We suggest that a web page is created that guides PhD students and supervisors in what courses are mandatory in the respective doctoral programs, and what general skills courses are recommended in order to further attain the higher ordinance goals as well as KTH's own goals. This information already exists in the ASPs of the different doctoral programs. Finally, we need to provide information about the elective general skills courses that are available and address additional general skills that KTH believes to be important. For this, the structure in Figure 1 can be used. Then, the matrix given in Appendix B can be used to show how the main goals are covered by the mandatory and recommended courses, and by other activities. Furthermore, a list such as the one given in Appendix A can be used to inform about all electable general skills courses.

Some recommended courses that have been developed at some programme from a specific research perspective, could be mimicked by other programmes as well. One example is the *Dis-course* at Mediated Communication in which students read a thesis and perform auscultation on the defence of it, to learn how to write a thesis with good quality, and learn how to defend it. That is a really good course, but for obvious reasons it will require adaptation in the context of a different research area.

## 5. Analysis of the Proposed Process

Here, we analyse the proposed process w.r.t. the requirements described in Section 2.

### A. Courses and Goals

All goals stipulated by the Higher Education Ordinance and KTH that need to be examined by means of courses are already covered in each of the 4 doctoral programmes. Currently only the aspect of JML needs to be incorporated. We consider the following four options for how to achieve this:

1. KTH devises a course centrally to which we send our students.
2. EECS devises a course centrally that our students take.
3. KTH sends us a teacher that can be responsible for a new mandatory course on JML that we establish locally at EECS. (Note that for options 1,2 and 3 we would need to make this a mandatory course, thereby increasing the number of mandatory credits at each program.)
4. KTH sends us a teacher that serves as a *guest teacher* covering the aspects of JML in the respective mandatory courses that we already have locally at EECS. In this case the content in those courses has to be negotiated with the respective teacher to accommodate the new JML part. We favour this option, since in this case the course can be adapted to continue having the same number of credits, and there will thus be no need to expand the mandatory number of credits.

Further, we consider a number of additional goals as meaningful for the education of doctoral students and their professional preparation.

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## B. Flexibility and Extensibility

Our suggested process allows the creation of new elective general skills courses. On the other hand, there is not much space in terms of course credits left for adding new mandatory courses or extending the existing ones. Thus any new goal, except for JML, will need to be addressed by elective courses and other activities.

## C. Sustainability and Robustness

The suggested process is sustainable in that it secures funding for the development of new general skills courses and the operation of existing ones.

There are different mandatory courses in the different programmes. In general, we advise the doctoral students to take the mandatory courses at their respective programme. However, we shall provide additional robustness to the process by allowing, in case of an unplanned disruption of a mandatory course or unavailability of a teacher, the students to take a corresponding course at another programme. This may be more or less challenging depending on how different the doctoral programmes are.

Differences in the research topics is something KTH and society values. Having well defined doctoral programmes that address complementing research topics is essential. The goal should be to further foster excellence in each research topic, and then to support interdisciplinary collaborations between them. Developing new courses that bridge different research topics, at EECS and even across KTH, to increase interdisciplinary research, would be a future goal to strive for.

## D. Efficiency

The coexistence of 4 doctoral programmes allows certain general skills courses to group students in ways that allow for a more efficient use of teaching resources, in particular of teachers' time. We shall apply this principle when designing new elective general skills courses.

On the other hand, we do not see possibilities to apply this principle to the existing mandatory courses. Apart from the aspect of the different specifics of research methods and traditions, the large numbers of doctoral students at our programmes has led to the size of classes already being stretched to their operational and meaningful maximum. For example, the mandatory course FDD3001 at the CS programme is now given twice a year instead of once, due to the increased numbers of doctoral students. This is an indication of the efficient use of its teacher, Arvind Kumar.

## E. Information and Documentation

Our process will be accompanied by a web page with information about the different types of general skills courses, and will visualize the information by means of diagrams and lists.

## 6. Conclusion

In summary, we propose a process for the creation and operation of general skills courses. The process meets a number of important requirements, as stated in Section 2.

We advocate to keep the current structure of mandatory courses, but for reasons of robustness, we will prepare the teachers to allow doctoral students from other programmes in emergency situations. We will also make it possible for a doctoral student from one

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programme to take a mandatory course from another programme as a recommended or elective course. We will be helpful when deciding on the funding strategy for this, applying as few rules as possible.

We will make it clear, on a web page, how the recommended courses can support further attaining of the main goals, and what other elective courses can be considered general skills courses.

We propose to fully fund all mandatory and recommended courses from the budgets of the doctoral programmes. We will set a limit on the number of students for each course round, which will allow us to compute a minimal fee per student, to be covered by the programme to which the student belongs.

## Appendix A: General Skills Courses at Other KTH Schools

<a href="#">FDS3102</a>	<a href="#">Writing Scientific Articles</a>	5.0 hp	ITM
<a href="#">FDS3103</a>	<a href="#">Introduction to Scientific Writing</a>	2.0 hp	ITM
<a href="#">FDS3103</a>	<a href="#">Introduction to Scientific Writing</a>	2.0 hp	ITM
<a href="#">FLF3001</a>	<a href="#">Writing Successful Research Applications in Learning</a>	7.5 hp	ITM
<a href="#">FLF3003</a>	<a href="#">Litterature Course; Education and Communication in Technology Sciences</a>	7.5 hp	ITM
<a href="#">FLF3004</a>	<a href="#">Litterature Course; Education and Communication in Technology Sciences</a>	7.5 hp	ITM
<a href="#">FLF3005</a>	<a href="#">Litterature Course; Education and Communication in Technology Sciences, I</a>	3.0 hp	ITM
<a href="#">FLH3000</a>	<a href="#">Basic Communication and Teaching</a>	3.0 hp	ITM
<a href="#">FLI3117</a>	<a href="#">Innovation in Academic Research - IPR and communication of research results</a>	2.0 hp	ITM
<a href="#">FLS3107</a>	<a href="#">Communicating Research beyond the Academy</a>	5.0 hp	ITM
<a href="#">FMF3033</a>	<a href="#">Innovation Management</a>	7.5 hp	ITM
<a href="#">FMF3201</a>	<a href="#">Well - Informed Management. Gender Equality and Diversity</a>	6.0 hp	ITM
<a href="#">FMG3801</a>	<a href="#">Research seminars in Sustainable Production Development</a>	7.5 hp	ITM
<a href="#">FMG3802</a>	<a href="#">State of the art within Sustainable Production Development</a>	7.5 hp	ITM
<a href="#">FMJ3388</a>	<a href="#">Sustainability Perspectives for Assessing and Designing Research, Projects and Policies</a>	6.0 hp	ITM
<a href="#">FSG3133</a>	<a href="#">Engineering for a Sustainable Society</a>	3.0 hp	SCI
<a href="#">FSH3216</a>	<a href="#">High-tech Entrepreneurship</a>	7.5 hp	SCI

<a href="#">FAD3115</a>	<a href="#">Gender and Sustainability: Introducing Feminist Environmental Humanities</a>	7.5 hp	ABE
<a href="#">FAD3115</a>	<a href="#">Gender and Sustainability: Introducing Feminist Environmental Humanities</a>	7.5 hp	ABE
<a href="#">FAE3006</a>	<a href="#">Research Communication, Publishing, Presentation and Critical Evaluation, Part 1 for Lic. Degree</a>	4.5 hp	ABE
<a href="#">FAE3007</a>	<a href="#">Research Communication, Publishing, Presentation and Critical Evaluation, part 2 for PhD. Degree</a>	3.0 hp	ABE
<a href="#">FAE3011</a>	<a href="#">Writing Popular Science Publications</a>	1.5 hp	ABE
<a href="#">FAE3014</a>	<a href="#">Writing applications for research funding</a>	1.5 hp	ABE
<a href="#">FAG3172</a>	<a href="#">Communicating Planning Research to Academic Audiences</a>	7.5 hp	ABE
<a href="#">FAG3206</a>	<a href="#">Futures Studies for Sustainability</a>	7.5 hp	ABE
<a href="#">FAI3201</a>	<a href="#">Literature Course in Project Communication 1</a>	7.5 hp	ABE
<a href="#">FAI3202</a>	<a href="#">Literature Course in Project Communication 2</a>	7.5 hp	ABE

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<a href="#">FAL3205</a>	<a href="#">Advanced Issues in Project Communication</a>	7.5 hp	ABE
<a href="#">FAL3305</a>	<a href="#">Gender, Work and Education</a>	7.5 hp	ABE
<a href="#">FAL3306</a>	<a href="#">Financing of Entrepreneurship</a>	7.5 hp	ABE
<a href="#">FAK3105</a>	<a href="#">Writing Course for Doctoral Students</a>	3.0 hp	ABE
<a href="#">FAK3127</a>	<a href="#">The Sustainable Scientist</a>	2.0 hp	ABE
<a href="#">FAK3134</a>	<a href="#">Essay in Popular Science</a>	3.0 hp	ABE
<a href="#">FAK3135</a>	<a href="#">Advanced Course in Writing for a Popular Audience</a>	4.5 hp	ABE
<a href="#">FAK3145</a>	<a href="#">Research Communication</a>	7.5 hp	ABE
<a href="#">FAL3113</a>	<a href="#">Sustainable Development in a Global Perspective</a>	7.5 hp	ABE
<a href="#">FAL3114</a>	<a href="#">Sustainability Science</a>	7.5 hp	ABE
<a href="#">FAL3509</a>	<a href="#">Social Practice Theory (STP) for Research on Sustainable Development</a>	4.5 hp	ABE
<a href="#">FAL3512</a>	<a href="#">Methods in Sustainability Science</a>	7.5 hp	ABE
<a href="#">FAL3513</a>	<a href="#">Literature Course in Strategies for Sustainable Development</a>	7.5 hp	ABE
<a href="#">FCK3503</a>	<a href="#">Engineering for a Sustainable Society</a>	3.0 hp	CBH
<a href="#">FHN3009</a>	<a href="#">Grant Proposal Writing</a>	4.5 hp	CBH
<a href="#">FHN3016</a>	<a href="#">Writing and Publishing Research Papers</a>	3.0 hp	CBH



## Appendix B: Goals and Mandatory General Skills Courses

Nr.	Goal	FLH3000 (EE)	FAK3014 FAK3012 (EE)	FDS3103 (EE)	FAK3127 (EE)	FIL3606 (ICT)	FDM3514 (MC)	FDD3001 (CS)
1	<b>Kunskap och förståelse</b>							
1.1	Visa brett kunnande inom och en systematisk förståelse av forskningsområdet samt djup och aktuell specialistkunskap inom en avgränsad del av forskningsområdet						X	
1.2	Visa förtrogenhet med vetenskaplig metodik i allmänhet och med det specifika forskningsrådets metoder i synnerhet		X			X	X	X
2	<b>Färdighet och förmåga</b>							
2.1	Visa förmåga till vetenskaplig analys och syntes samt till självständig kritisk granskning och bedömning av nya och komplexa företeelser, frågeställningar och situationer		X			X	X	
2.2	Visa förmåga att kritiskt, självständigt, kreativt och med vetenskaplig noggrannhet identifiera och formulera frågeställningar samt att planera och med adekvata metoder bedriva forskning och andra kvalificerade uppgifter inom givna tidsramar och att granska och värdera sådant arbete		X			X	X	
2.3	Med en avhandling visa sin förmåga att genom egen forskning väsentligt bidra till kunskapsutvecklingen			X			X	

2.4	Visa förmåga att i såväl nationella som internationella sammanhang muntligt och skriftligt med auktoritet presentera och diskutera forskning och forskningsresultat i dialog med vetenskapssamhället och samhället i övrigt	X		X		X		
2.5	Visa förmåga att identifiera behov av ytterligare kunskap	X				X		
2.6	Visa förutsättningar för att såväl inom forskning och utbildning som i andra kvalificerade professionella sammanhang bidra till samhällets utveckling och stödja andras lärande	X		X		X		
<b>3</b>	<b>Värderingsförmåga och förhållningssätt</b>							
3.1	Visa intellektuell självständighet och vetenskaplig redlighet samt förmåga att göra forskningsetiska bedömningar			X		X		X
3.2	Visa fördjupad insikt om vetenskapens möjligheter och begränsningar, dess roll i samhället och människors ansvar för hur den används			X		X		X
<b>4</b>	<b>Additional (KTH)</b>							
4.1	Visa kunskaper om och förmåga att göra relevanta miljömässiga och etiska bedömningar för att kunna bidra till en hållbar samhällsutveckling			X				X