



Theory and Methodology of Science - TaMoS

FAK3014 (3 Credits) course memo period 2, 2022

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Introduction

A warm welcome to this course! In this course you will learn about the theory and methodology of science through a series of online lectures, seminars, and quizzes. The course ends with an exam. A 3 credits course represents 8 hours of study each week, including scheduled hours.

Advice from previous students

In course evaluations for previous periods, students wanted to pass on the following advice.

- This course is different from many other courses in an engineering degree, and often requires a slightly different approach.
- It is a good idea to follow along with the course structure, such as watching lectures when they are scheduled and completing the quizzes.
- It is useful to take careful notes during the lectures. However, this increases the viewing time of the videos, so you need to plan for that.
- Taking time to prepare for the seminars and actively engaging in the seminars makes it much easier to understand the course concepts and pass the exam.

Intended learning outcomes

The course provides an introduction to the theory and methodology of science and is intended for the beginning PhD student. One aim is to supply the basic concepts needed for placing the techniques and knowledge acquired in the student's other courses or research in the wider context of the natural sciences. Another aim is to provide the basic intellectual tools that allow for a reasoned and critical

assessment of results and methods from the wide variety of disciplines that the student is likely to encounter during his or her continued career in research and/or in professional life.

The course is mainly focused on the general theoretical and methodological issues that arise in the natural and technological sciences; but basic theoretical issues, techniques and problems from the social sciences are also covered to provide the student with a wider outlook. Emphasis is placed on the fundamental problems common to the natural sciences and on the general strategies, methods and concepts that modern science has developed to address these problems.

After having completed the course, the student should, with regards to the theory and methodology of science, both orally as well as in writing, be able to:

- Identify definitions and descriptions of concepts, theories and problem areas, as well as identify the correct application of these concepts and theories.
- Account for concepts, theories and general problem areas, as well as apply concepts and theories to specific cases.
- Critically discuss the definitions and applications of concepts and theories as they applies to specific cases of scientific research.

The course is examined through three seminars (1 credit), and an exam (2 credits).

Disability – Support via Funka

If you have a disability, you may receive support from Funka. More information at: <https://www.kth.se/en/student/studentliv/funktionsnedsattning>. We recommend you inform us regarding any need you may have since Funka does not automatically inform the teacher.

Contact information

Please send any questions by e-mail to Henrik Lundvall (course responsible): henrik12@kth.se. Please make sure to always include your course code. Do not use the Canvas messaging system, as we cannot track which questions have been answered or not. You are also welcome to schedule a meeting by sending an e-mail Henrik.

Examiner: Till Grüne-Yanoff, gryne@kth.se
 Course responsible: Henrik Lundvall, henrik12@kth.se

Schedule

You find the course schedule on www.kth.se/schema, by searching for your course code.

You can find due dates for the assignments and quizzes on Canvas, under assignments.

Course literature

There are one main course texts:

- *Justified Method Choice - Scientific Methodology for Scientists and Engineers* by Till Grüne-Yanoff.

In addition, there are three supplemental texts:

- *The Art of Doing Science* by Sven Ove Hansson.
- *Some Issues in the Philosophy of Technology* by Sven Ove Hansson.
- *Ethical Thinking* by Jesper Ahlin.

All are available in the file format pdf from the Canvas pages. They cannot be bought as physical books, but you are welcome to print them. On the Canvas page “Reading instructions” you can see which sections to read for the lectures. There are also texts for the seminars, see the document “Seminar information” on Canvas.

Lectures

This course includes the following nine lectures. They are all available as videos on Canvas to watch whenever you want. Their place in the schedule is a suggestion of when you might view it.

1. Introduction and scientific knowledge (26 minutes)
2. Scientific inferences (59 minutes)
3. Observation and measurement (76 minutes)
4. Experiments (49 minutes)
5. Models (62 minutes)
6. Statistics (62 minutes)
7. Explanations and causes (81 minutes)
8. Engineering design (76 minutes)
9. Qualitative methods (93 minutes)

From the second lecture onward, there is an associated optional quiz of 15 questions. If you complete the quiz with at least 14 points, you will get 0,5 bonus points for the exam. You can attempt to complete the quiz as many times as you like until it closes. This quiz closes at the end of the week where the lecture is scheduled (Sunday, 23:59, of each week). This is to incentivise studying throughout the course, rather than only at the end. Bonus points collected during this period are valid for the exam and the re-exam belonging to this period.

In addition to the quizzes, there are two flipped classrooms. During these hours, the lecturer answers your questions. You need to have asked the question on a discussion forum (link available on Canvas) and you will be able to like other people's questions.

Seminars, 1 credit

This course includes these three mandatory seminars.

1. Definitions, operationalizations and hypotheses
2. Designing a scientific study
3. Interpretation, analysis, and evidence

For each seminar, there are texts to read and a quiz to complete before you take the seminar. You need 14 points on the quiz before attending. If you attend without having scored 14 points on the quiz, you are not sufficiently prepared, and you will not be marked as attending. You can take the quiz as many times as you want before your seminar.

You will take one seminar each seminar week. There is more information about the seminars in the document "Seminar information" on Canvas.

Expected workload: 8 hours per week.

Schedule: www.kth.se/schema. Chose "Course" and search for your course code. Note that for each seminar, there are several groups. Some groups may be cancelled. Furthermore, the seminars share content with courses AK2030 & AK2036, so there are usually other groups to attend if you have scheduling issues. Contact course administration after the start of the course.

Exam, 2 credits

The examination is based on the 9 lectures and the 3 seminars, as well as the course literature. It is given in Canvas on the date and time indicated in the schedule. It consist of three parts. The first part is a multiple choice part asking you to identify the definitions and applications of course concepts. The second part is an essay part where you are to submit computer written answers to two problems. In this part you are asked to account for the course concepts, apply them to examples and discuss their definitions. The third part is an essay part where you choose one out of three problems where you are asked to account for, apply and discuss course concepts.

The exam is open-book, which means that one is allowed to use the course literature when answering the questions. Plagiarism is not allowed and any citations, even from the course literature, must be marked as such. Co-operation is not allowed.

During the course there are 8 non-mandatory quizzes, one for each video lecture. These quizzes test the students' ability to identify the correct definition and application of the course concepts. Passing these quizzes awards bonus points, 0,5 point per lecture. There are also two flipped classroom sessions where students can collect 0,5 bonus points per session. The bonus points from quizzes and flipped classrooms are then scaled to fit the exam format and added to the part 1 exam score, capped at the maximum for that part. Bonus points are valid for the exam and re-exam belonging to the period and year when they were collected. One may collect points valid for another exam by re-registering for that period and re-taking the quizzes.

Fee

A fee of 2400 SEK will be billed to your department once you have been registered. Please add the billing information here: <https://www.kth.se/form/5eba5fd5fbbd7721034b2837>