AK2040 Theory and Methodology of Science with Applications (Computational Science) 7.5 credits

Vetenskapsteori och vetenskaplig metodik med tillämpningar (beräkningsvetenskap)

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for AK2040 valid from Autumn 2022

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Specific prerequisites

General requirements for master's programmes. Proficiency in English corresponding to English B / English 6 in Swedish gymnasium.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

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.

These learning objectives are examined in writing via a digital exam and orally via seminars.

- chart the main lines of thought in some different philosophical theories about the nature of mathematical objects and our knowledge of them.
- describe the content of some representation theorems from the theory of measurement, and discuss the import of these theorems concerning the relationship between mathematical structures and the material world.
- compare different mathematical models of one and the same phenomenon with regard to theoretical virtues such as simplicity, agreement with observations, etc.

These learning objectives are examined in writing via a project work.

Course contents

The following is an incomplete list of topics covered in the course.

- Scientific knowledge
- Definitions
- Hypothesis testing
- Observations and measurements
- Experiments
- Models
- Statistical reasoning
- Causes and explanations
- Qualitative methods
- Algorithmic reasoning and its limitations

- Risk and decisions of risks
- Research ethics
- Philosophical theories about mathematical objects' nature
- Theorethical representation theorems of measurement
- Theoretical virtues in mathematical models

Examination

- SEM1 - Seminars, 1.5 credits, grading scale: P, F
- PRO1 - Project, 3.0 credits, grading scale: P, F
- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

TEN1 is examined via a digital exam. The examiner decides, based on recomendation from KTH's coordinator for disabilities, if a custom-made examination for students with documented disabilities is appropriate.

Other requirements for final grade

Fullfilled seminar requirements, project requirements and written exam.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.