

Scientific Methodology for Engineering and Natural Science Vetenskaplig metodik för teknik och naturvetenskap

15 credits

15 högskolepoäng

Ladok Code: AT2VM1

Version: 2.2

Established by: Committee for Education in Technology 2019-10-11

Valid from: Autumn 2019

Education Cycle: Second cycle

Main Field of Study (Progressive Specialisation): Textile Engineering (A1F), Theory of Science (A1F)

Disciplinary Domain: Technology

Prerequisites: Admitted to the MSc Programme in Textile Engineering and 52.5 credits earned or equivalent qualifications.

Subject Area: Textile Technology

Grading Scale: Seven-degree grading scale (A-F)

Content

The course is intended to give the students profound knowledge of the foundation of science: philosophy of science, ontology and epistemology and understanding of the research process, identification of research problems and knowledge gaps, formulation of research questions, the role of theories and significance of empirical evidence. With this foundation in place the primary focus is to make this particular group of students comfortable in quantitative methods, to master statistical methods in order to plan, conduct and analyze experimental work and stringently convey scientific results to scholars and peers. Along with the quantitative theory of science part the course should also prepare the students for multidisciplinary environments where qualitative scientific methods are prevailing. The course refines the students' ability to critically review scientific literature to build foundations for their individual thesis subjects. Assisted by their thesis supervisor they compile comprehensive review papers. These papers should have a wider scope than their theses and should stand alone. Seminars, lectures and essays are other forms of teaching. Hands-on coaching is also offered to analyze the data that is generated during the theses projects that run in parallel with this course.

Learning Outcomes

The examinee shall independently be able to:

Knowledge and understanding

- 1.1 describe the development of scientific ideas from both a historical and philosophical perspective,
- 1.2 account for the basis of science: philosophy of science, ontology and epistemology,
- 1.3 describe essential scientific theoretical concepts and outline their weaknesses and strengths,
- 1.4 account for and choose among different methods of software based data analysis such as Minitab,
- 1.5 relate frameworks, methods and results to different research disciplines, and
- 1.6 outline how a review paper should be constituted.

Skills and abilities

- 2.1 define appropriate samples and predict sufficient sample sizes and number of replicates to reach statistical certainty,
- 2.2 apply appropriate statistical methods to analyze sets of empirical data,
- 2.3 use hypotheses in once research,
- 2.4 use statistical software, such as Minitab, for statistical analysis of given and original empirical data,
- 2.5 review and evaluate scientific literature with a critical approach both from quantitative and qualitative domains,
- 2.6 take advantage of other researchers work and compile in literature reviews suitable for peer review publication,
- 2.7 communicate literature reviews and outlined research methods both orally and visually, and
- 2.8 orally and in writing describe and give account for peer's thesis plans in a critical manner.

Judgement and approach

3.1 reflect upon own and peer's outlined research plans from a methodological and theory of science perspective.

Forms of Teaching

Teaching comprises lectures, seminars, self-studies, presentations, written assignments in form of essays and review paper, consultations, statistical analysis assignments and supervision.

The language of instruction is English.

Forms of Examination

The following examinations will form part of this course with respect to the stated learning objectives:

- Written individual assignment Review Paper
Higher education credits: 6.0
Grade: A-F
(Corresponding to Learning outcomes 1.6, 2.5-2.7)
- Oral and visual presentation of Review paper findings
Higher education credits: 1.0
Grade: UG
(Corresponding to Learning outcomes 2.5-2.7)
- Peer review and opposition of Review Paper
Higher education credits: 0.5
Grade: UG
(Corresponding to Learning outcomes 2.5-2.8)
- Essay 1: Assignment on Philosophy of Science and Qualitative Methods
Higher education credits: 2.0
Grade: UG
(Corresponding to Learning outcomes 1.1-1.3, 1.5, 2.3, 2.5, 3.1)
- Essay 2: Written assignment Thesis Planning Report
Higher education credits: 2.0
Grade: UG
(Corresponding to Learning outcomes 1.1-1.3, 1.5, 2.1, 2.3, 3.1)
- Oral presentation of Thesis Planning Report
Higher education credits: 0.5
Grade: UG
(Corresponding to Learning outcomes 1.1-1.3, 1.5, 2.1, 2.3, 2.7)
- Peer review and opposition of Thesis Planning report
Higher education credits: 0.5
Grade: UG
(Corresponding to Learning outcomes 1.2, 1.3, 1.5, 2.8, 3.1)
- Assignment on Data Analysis
Higher education credits: 2.5
Grade: A-F
(Corresponding to Learning outcomes 1.4, 2.1-2.2, 2.4-2.5)

Students must pass all examinations in order to achieve a minimum final grade of E, which will be the mean of written individual assignments Review Paper and Data Analysis weighted in accordance with their credits.

If the student has received a decision/recommendation regarding special pedagogical support from the University of Borås due to disability or special needs, the examiner has the right to make accommodations when it comes to examination. The examiner must, based on the objectives of the course syllabus, determine whether the examination can be adapted in accordance with the decision/recommendation.

Student rights and obligations at examination are in accordance with guidelines and rules for the University of Borås.

Literature and Other Teaching Methods

Creswell JW (2017) *Research Design Qualitative, Quantitative, and Mixed Methods Approaches*, SAGE Publications

Montgomery DC (2009) 7th Ed. *Design and Analysis of Experiments*, Wiley

Hempel, Carl (1966) *Philosophy of Natural Science*, Princeton University, Prentice-Hall, New Jersey, USA

A selection of articles and chapters will be included, maximum 400 pages.

Student Influence and Evaluation

The views of students will be canvassed systematically and regularly by means of written course assessments once courses are complete. Student representatives will work together with the Director of Studies and the course manager once a term to review courses held. For further information, please see the Colleges policy on course assessments and documents prepared by the Institutional Board, Director of Studies and course manager.

Miscellaneous

The course is first and foremost a programme course for the Master's Programme in Textile Engineering.

This syllabus is a translation from the Swedish original.