Swedish University of Agricultural Sciences

P000148, Fundamentals of Optimization: An Interdisciplinary and Applied Approach, 4.5 Hp

Syllabus

Finalized by: FUN S, 2025-04-11

Valid from: VT2025

Level within study regulation:

Third cycle

Grading scale:

Pass / Failed

Course language:

Swedish

Entry requirements:

Doctoral students that are admitted to SLU or to another University.

Objectives:

On completion of the course, the student will be able to:

1.- Describe what an optimization problem is and identify its key components (objective function, decision variables, and constraints).

2.- Classify different types of optimization problems, such as linear vs. nonlinear and single vs. multi-objective.

3.- Formulate simple optimization problems from real-world scenarios and from their own research projects.

4.- Use computational tools to apply basic optimization techniques and solve simple problems.

5.- Interpret the results of optimization models, understanding trade-offs and constraints.

Content:

The course introduces the fundamental concepts of optimization, focusing on real-world applications in various disciplines such as forestry, economics, engineering, biology and beyond. Students will learn how to formulate, analyse, and solve basic optimization problems while considering constraints, trade-offs, and decision-making processes.

The course covers:

• Fundamental principles of optimization modelling.

• Types of optimization problems: linear vs. nonlinear, single vs. multi-objective.

• Introduction to common solution methods, including classical algorithms and meta-heuristic approaches.

• Hands-on implementation using computational tools and coding.

• Interpretation of optimization results and limitations.

The course includes a mix of lectures, practical coding sessions with real-world examples from different disciplines, fostering a broader interdisciplinary perspective on optimization. Alongside lectures, students will complete a series of assignments that gradually build their skills, from connecting optimization to their own field, to solving practical problems, and exploring trade-offs in decision making. The course concludes with a final project in which each student formulates and analyses an optimization problem relevant to their research.

Modes of assessment:

1.- Approved assignments.

2.- Approved final project. - If a student has failed an examination, the examiner has the right to issue supplementary assignments. This applies if it is possible and there are grounds to do so.

- The examiner can provide an adapted assessment to students entitled to study support for students with disabilities following a decision by the university. Examiners may

also issue an adapted examination or provide an alternative way for the students to take the exam.

- If this syllabus is withdrawn, SLU may introduce transitional provisions for examining students admitted based on this syllabus and who have not yet passed the course.
- For the assessment of an independent project (degree project), the examiner may also allow a student to add supplemental information after the deadline for submission. Read more in the Education Planning and Administration Handbook.

Organisation:

Department of Forest Biomaterials and Technology

Supplementary information

Other information:

- The right to participate in teaching and/or supervision only applies for the course instance the student was admitted to and registered on.
- If there are special reasons, students are entitled to participate in components with compulsory attendance when the course is given again. Read more in the Education Planning and Administration Handbook.