

## Course description

**Name of course:** Near infrared spectroscopy in soil science

**ECTS credits:** 5

### **Course parameters:**

*Language:* English

*Level of course:* PhD

*Semester/quarter:* Q2 2021

*Hours per week:* 45 hours preparatory reading, 35 hours lectures and 20 hours group work including laboratory work, 40 hours preparing final report

*Capacity limits:* 20 students

**Objectives of the course:** The course is designed to provide an in depth theoretical and practical knowledge of visible near-infrared spectroscopy (NIRS) and its application to soil science. The objectives of the course are to develop the participants' ability to use NIRS sensors and provide the basic skills to analyse soil spectra. The overall goal is to show the possibilities of NIRS and contribute to innovative soil analysis that can provide fast and accurate estimates of soil properties illustrating the potential alternative to current traditional wet chemistry analysis. This novel spectroscopic approach to analysing soils can generate high quality and cheap soil data which can serve as input to precision agriculture, soil health monitoring, soil management, and environmental protection tasks.

### **Learning outcomes and competences:**

At the end of the course the students **should be able to:** describe the principals of NIR spectroscopy as well as to summarize its application to soil analysis. They will be able to perform lab analysis on soil samples using NIRS sensor. They will obtain theoretical knowledge about the principals on developing calibration models as well as they will obtain basic skills to use software functions and methods for exploratory data analysis and spectral model generation for basic soil properties estimation. The students will learn to critically evaluate the performance of the models. The students will also be able to list the possible advantages and disadvantages of NIRS applications to soils and will reflect on the possible application of this technique in their own research areas.

### **Compulsory programme:**

Daily morning lectures will introduce the students to the topics of the course. After, the students will participate in group work based on hands-on laboratory and computer assignments. On the last day of the course the students will give presentations with the main findings from their assignments. The course will cover the following topics:

- Fundamentals of NIRS
- Calibration considerations
- Sample preparation
- Instrumentation: theory and hands-on experience
- Examples of the NIRS-based estimations of basic and functional soil properties using lab and in-field collected data

- Chemometrics: theory and computer exercises

**Prerequisites:**

Target group would be the PhD students within soil science, agronomy, or environmental engineering with a basic knowledge of soils and statistics.

**Name of lecturer[s]:**

Maria Knadel and Cecilie Hermansen, Department of Agroecology, Aarhus University.  
Johanna Wetterlind and Bo Stenberg, Department of Soil and Environment, Swedish University of Agricultural Sciences

**Type of course/teaching methods:**

The course is combining both the in-depth theoretical knowledge and most importantly hands-on experience including: i) laboratory measurements using the high technology spectroscopy instrumentation, as well as ii) computer exercises giving the students an opportunity to work with the data they generate during the course and gaining skills in sophisticated multivariate data analysis using a dedicated software. The course will include a mixture of lectures, group-work and presentations.

**Literature:**

Pre-reading: the students will be provide with reading materials two weeks prior to the course.

**Course homepage:**

Will be available two weeks prior to course start

**Course assessment:**

The students are evaluated based on the active participation through the course-week, and on the basis of the final report. The report with the main results from the lab and computer exercises has to be handed in after the course.

**Provider:**

Dept. of Agroecology  
Aarhus University  
Blichers Allé 20, Postboks 50  
DK-8830 Tjele

**Special comments on this course:**

Course fee is € 600 or DKK 4,500. Registration for the course via this link

<https://tilmeld.events/nearinfrared2021/signup>

**Time:**

6 – 12 September 2021.

**Place:**

Meeting room # 2, AU, Campus Foulum and the landscapes of Denmark

**Registration:**

Deadline for registration is August 1, 2020. Information regarding admission will be sent out no later than August 24.

For registration: <https://tilmeld.events/nearinfrared2020>

If you have any questions, please contact Maria Knadel, email: [maria.knadel@agro.au.dk](mailto:maria.knadel@agro.au.dk)

**PLEASE NOTE**