COURSE DESCRIPTION

COURSE DETAILS

Title (of the course): **USE OF NIRS TECHNOLOGY FOR FEED AND FOOD CHARACTERIZATION AND SAFETY**
Code: 102294
Degree/Master: **GRADO DE CIENCIA Y TECNOLOGÍA DE LOS ALIMENTOS** Year: 4
Field:
Character: OPTATIVA
Duration: SECOND TERM
ECTS Credits: 3.0
Classroom hours: 30
Face-to-face classroom percentage: 40.0%
Study hours: 45
Online platform:

LECTURER INFORMATION

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PREREQUISITES AND RECOMMENDATIONS

Prerequisites established in the study plan

The students must have at least a B-1 level of English language to be enrolled.

Recommendations

It is advisable that students have at least a B-2 level in English language.

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INTENDED LEARNING OUTCOMES

CB2	To know how to apply knowledge to their work or vacation in a professional way. To have the skills that are usually demonstrated through the elaboration and defence of arguments and the resolution of problems within their area of study.
CU1	To prove mastery in the use of a foreign language.
CG3	To be able to work as part of a team.
CG4	Ability to apply theoretical knowledge in practice.
CG9	To develop initiation skills for scientific work and technical reports.
CE3	To know the techniques and perform food analyses that guarantee optimal conditions for human consumption.
CE7	To analyse the biological, physical and chemical hazards of the food chain in order to protect public health.

OBJECTIVES

The main goal of this subject is to provide the students with knowledge and competences on Near Infrared (NIR) technology, which is nowadays widely used and demanded in animal feeding and food industries as eco-friendly, fast, reliable, and non-destructive tool for quality control.
Specific goals:
1. To know the importance of the characterization of feed and products of animal and vegetable origin for human consumption from the food safety point of view.
2. To know the basics of NIRS (Near Infrared Spectroscopy) technology and its current use to support the decision-making of professionals responsible for the control of products and processes in the agro-food chain.
3. To learn to develop NIR predictive models, highly-demanded in the agro-food industry for quality control.
4. Introduction to research on new trends in the use of NIRS technology in food safety.

CONTENT

1. Theory contents

The subject will be divided into four modules. Each module will be split into individual lessons that deal with several aspects related to the corresponding topic:
MODULE I: Importance of the characterization and authentication of feeds and foods of animal and vegetal origin from the process control and food safety point of view. Methods of control: advantages and disadvantages.
MODULE II: NIRS technology as a tool to support decision making: advantages and disadvantages. Current uses of NIRS technology in the agro-food industry. Versatile and dedicated instruments.
MODULE III. NIRS Technology: Basic Concepts. NIRS analysis modes. Study of spectral populations. Development of quantitative and qualitative calibration models. Statistical evaluation of calibrations. External validation.
MODULE IV: New research lines on the use of NIRS technology in the characterization and authentication of products and food safety. Research lines based on NIRS of the teaching staff of the current subject.

2. Practical contents

- Official methods of food analysis and other technologies of control: advantages and disadvantages.
-NIRS analysis and most used instruments in the agro-food industry.
- Development and evaluation of NIRS predictive models.
- New trends in the use of NIRS technology in food safety.

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SUSTAINABLE DEVELOPMENT GOALS RELATED TO THE CONTENT

Good health and well-being
Quality education
Affordable and clean energy
Industry, innovation and infrastructure
Responsible consumption and production

METHODOLOGY

General clarifications on the methodology (optional)

CLIL (Content and Language Integrated Learning) methodology will be used to create a 'natural' environment for contents and language learning, and to acquire specific vocabulary throughout the course.

Methodological adaptations for part-time students and students with disabilities and special educational needs

The required methodological adaptations will be taken into account and in accordance with current Regulations for both part-time students and students with disabilities and special educational needs.

Face-to-face activities

Activity	Large group	Medium group	Total
Assessment activities	1	-	1
Development and evaluation of chemometric	-	8	8
Lab practice	-	2.5	2.5
Lectures	15.5	-	15.5
NIRS analysis	-	3	3
Total hours:	***16.5***	***13.5***	***30.0***

Off-site activities

Activity	Total
Developing chemometric models	12
Reference search	12
Self-study	21
Total hours	***45***

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WORK MATERIALS FOR STUDENTS

Exercises and activities
PDF files (via Moodle) and handouts dealing with the different units will be provided.

Clarifications

PDF files with the main contents of the lectures will be uploaded on Moodle. For the practical sessions, videos, handouts, databases and other working materials will also be provided.

EVALUATION

Intended learning	Case study/clinical case discussion/scientific work discussion	Exams	Problem solving
CB2	X	X	
CE3		X	X
CE7	X		
CG3		X	X
CG4	X	X	X
CG9			X
CU1		X	
Total (100%)	***15%***	***50%***	***35%***
Minimum grade	***0***	***5***	***0***

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

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Method of assessment of attendance:

Regular attendance to theoretical and practical classes will count significantly in the evaluation. 80% of attendance will be required to pass the course. Attendance to the practical sessions is compulsory.

General clarifications on instruments for evaluation:

The students will be evaluated according to the competences. The evaluation system will be based on the level of acquisition of the competencies indicated in the course, through tests, continuous assessment, and seminars, bibliographic works, and practicals evaluations.

Except for the test, the validity time of each evaluation method will be of an academic year, including the extraordinary calls and the extraordinary call for completion of studies during that course.

Clarifications on the methodology for part-time students and students with disabilities and special educational needs:

Specific learning conditions will be provided for part-time students and students with disabilities and special educational needs.

Clarifications on the evaluation of the extraordinary call and extra-ordinary call for completion studies:

The evaluation of the extraordinary call and the extraordinary call for completion of the studies, when necessary, will be done in accordance with the University and the Faculty of Veterinary Medicine regulations. The students affected should get in contact with the professor responsible for the subject.

Qualifying criteria for obtaining honors:

The global mark should be higher than 9.5 out of 10.

BIBLIOGRAPHY

1. Basic Bibliography

FOOD AND FEED SAFETY:

Regulations:

Regulation 178/2002, general principles and requirements of food law. EFSA.

Regulation (EC) 852/2004, general hygiene requirements for all food business operators.

Regulation (EC) 853/2004, specific hygiene rules for food businesses dealing with food of animal origin.

Regulation (EC) 2073/2005, microbiological criteria for foodstuffs.

Regulation (EU) 2017/625, on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products.

Books:

Handbook of hygiene control in the food industry. 2005. Lelieveld, Mostert and Holah.

Industry Guide to Good Hygiene Practice. Milk and Dairy Products. 2010. Dairy UK.

NEAR INFRARED SPECTROSCOPY:

Books:

Handbook of Near-Infrared Analysis. 3rd Ed. 2008. Burns and Ciurczack.

Near-Infrared Technology in the Agricultural and Food Industries. 2nd Ed. 2001. Williams and Norris.

Near-Infrared Spectroscopy in Agriculture. 2004. N 44. Roberts, Workman, Jr. And Reeves III.

Near infrared Spectroscopy (NIRS) Analysis of forage quality. 1989. N 643. Martens, Shenk, and Barton II.

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Near Infrared Spectroscopy in Food Science and Technology. 2007. Ozaki, McClure and Christy.

Specific journals:

Journal of Near Infrared Spectroscopy. http://journals.sagepub.com/home/jns

Applied Spectroscopy. http://journals.sagepub.com/home/asp

NIR News. http://journals.sagepub.com/home/nir

2. Further reading

Webpages:

EFSA: https://www.efsa.europa.eu

Foss: https://www.fossanalytics.com

Bruker: https://www.bruker.com/products/infrared-near-infrared-and-raman-spectroscopy.html

COORDINATION CRITERIA

Common evaluation criteria

Tasks performance

SCHEDULE

Period	Assessment activities	Development and evaluation of	Lab practice	Lectures	NIRS analysis
1# Week	0,0	0,0	0,0	3,0	0,0
2# Week	0,0	0,0	0,0	2,5	0,0
3# Week	0,0	0,0	2,5	2,0	0,0
4# Week	0,0	2,0	0,0	2,0	0,0
5# Week	0,0	0,0	0,0	2,0	3,0
6# Week	0,0	3,0	0,0	2,0	0,0
7# Week	1,0	3,0	0,0	2,0	0,0
Total hours:	***1,0***	***8,0***	***2,5***	***15,5***	***3,0***

The methodological strategies and the evaluation system contemplated in this Course Description will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required.