

**1. General information****Course:** RESEARCH IN TOXICOLOGY APPLIED TO WILDLIFE**Code:** 310053**Type:** CORE COURSE**ECTS credits:** 6**Degree:** 2310 - MASTERS DEGREE PROGRAMME IN BASIC AND APPLIED RESEARCH IN HUNTING RESOURCES**Academic year:** 2021-22**Center:** 601 - E.T.S. AGRICULTURAL ENGINEERS AND MOUNTS AB**Group(s):** 20**Year:** 1**Duration:** First semester**Main language:** Spanish**Second language:** English**Use of additional languages:****English Friendly:** Y**Web site:****Bilingual:** N**Lecturer:** RAFAEL MATEO SORIA - Group(s): 20

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2. Pre-Requisites

Those general pre-requisites of the Máster. Course special interest for graduates in Chemistry, as well as other established for the Master.

3. Justification in the curriculum, relation to other subjects and to the profession

The studies are planned to form the student in wildlife toxicology, giving the necessary knowledge in this subject to develop the research tasks.

4. Degree competences achieved in this course**Course competences**

Code	Description
E01	
E02	
E04	
E05	
E06	
E07	
E08	
G01	
G02	
G04	
G05	
G06	
G07	
G08	
G09	
G10	

5. Objectives or Learning Outcomes**Course learning outcomes**

Description

6. Units / Contents

Unit 1: Introduction to toxicology: Definition and types of toxic. Dose-response relationship: types of toxicity. Routes of exposure. Absorption. Metabolism. Excretion. Toxicokinetics Bioaccumulation and biomagnification.

Unit 2: Biomarkers Definition of biomarker. Biomarkers of effect and exposure. Types of biomarkers of effect: specific and general.

Unit 3: Analytical techniques in toxicology: extraction and purification of organic and inorganic compounds, chromatography, UV-Vis spectrophotometry, absorption and atomic emission, mass spectrometry.

Unit 4: Agricultural management and biodiversity conservation. Indirect effects of pesticides. Population trends of wild birds.

Unit 5: Direct effects of agrochemicals. Pesticides: anticholinesterase insecticides, anticoagulant rodenticides, fungicides and herbicides. Fertilizers: Nitrates.

Unit 6: Problem of the use of poison. Origin, types of poison, diagnosis, actions.

Unit 7: Persistent organic pollutants Organochlorine pesticides. PCBs. Dioxins and furans. Endocrine disruption

Unit 8: Emerging contaminants: diphenyl polybrominated, polyfluorinated, nanomaterial ethers.

Unit 9: Oil pollution in the marine environment. Polycyclic aromatic hydrocarbons. Adverse effects in seabirds.

Unit 10: Plumbing in wild birds. Exhibition in waterfowl, land and raptors. Adverse effects of lead. Alternatives to lead ammunition.

Unit 11: Contamination by other heavy metals and metalloids: mercury, cadmium, arsenic, selenium.

Unit 12: Veterinary drugs: adverse effects on scavenger species. Diclofenac in Asian vultures, other anti-inflammatories and antibiotics.

Unit 13: Toxins Toxiinfections food. Botulism. Cyanobacterial toxins: microcystins and other types. Mycotoxins

Unit 14: Biomarkers Determination of cerebral acetylcholinesterase activity in animals exposed to organophosphates and carbamates. In vitro reactivation techniques of enzymatic activity.

Unit 15: Analytical Toxicology Analysis of pesticides and poisons: solvent extraction, purification by gel permeation chromatography and analysis by gas chromatography coupled to mass spectrometry.

Unit 16: Analytical toxicology: Determination of anticoagulant rodenticides

Unit 17: Analytical Toxicology Heavy metal analysis: microwave oven digestion and atomic absorption analysis in graphite chamber.

Unit 18: Field study

Unit 19: Experimental design.

Unit 20: Self Learning and Evaluation

7. Activities, Units/Modules and Methodology							
Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	E01 E02 G01 G04 G08	0.8	20	Y	Y	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E04 E05 G01 G04 G08	0.8	20	Y	Y	
In-class Debates and forums [ON-SITE]	project-based learning	E02 G02 G04 G05	0.06	1.5	Y	N	
Writing of reports or projects [OFF-SITE]	Reading and Analysis of Reviews and Articles	E01 E02 E06 G01 G04 G08	1.2	30	Y	N	
Group tutoring sessions [ON-SITE]	Group tutoring sessions	E08 G04 G06 G09	0.2	5	Y	N	
Writing of reports or projects [OFF-SITE]	Project/Problem Based Learning (PBL)	E02 E06 E07 G02 G05 G08	1.2	30	Y	N	
Problem solving and/or case studies [ON-SITE]	Group Work	E02 E06 E07 G01 G02 G04 G05 G06 G07 G08 G09 G10	0.5	12.5	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	E02 E04 E06 G01 G04 G08	1.2	30	Y	N	
Final test [ON-SITE]	Problem solving and exercises	E01 E02 E04 E05 E06 E07 E08 G01 G02 G04 G05 G06 G07 G08 G09 G10	0.04	1	Y	N	
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				
Total credits of out of class work: 3.6			Total hours of out of class work: 90				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System			
Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Oral presentations assessment	0.00%	100.00%	
Final test	100.00%	0.00%	
Total:	100.00%	100.00%	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Unit 1 (de 20): Introduction to toxicology: Definition and types of toxic. Dose-response relationship: types of toxicity. Routes of exposure. Absorption. Metabolism. Excretion. Toxicokinetics Bioaccumulation and biomagnification.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 2 (de 20): Biomarkers Definition of biomarker. Biomarkers of effect and exposure. Types of biomarkers of effect: specific and general.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2

Unit 3 (de 20): Analytical techniques in toxicology: extraction and purification of organic and inorganic compounds, chromatography, UV-Vis spectrophotometry, absorption and atomic emission, mass spectrometry.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 4 (de 20): Agricultural management and biodiversity conservation. Indirect effects of pesticides. Population trends of wild birds.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 5 (de 20): Direct effects of agrochemicals. Pesticides: anticholinesterase insecticides, anticoagulant rodenticides, fungicides and herbicides. Fertilizers: Nitrates.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Unit 6 (de 20): Problem of the use of poison. Origin, types of poison, diagnosis, actions.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 7 (de 20): Persistent organic pollutants Organochlorine pesticides. PCBs. Dioxins and furans. Endocrine disruption	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Unit 8 (de 20): Emerging contaminants: diphenyl polybrominated, polyfluorinated, nanomaterial ethers.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 9 (de 20): Oil pollution in the marine environment. Polycyclic aromatic hydrocarbons. Adverse effects in seabirds.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Unit 10 (de 20): Plumbing in wild birds. Exhibition in waterfowl, land and raptors. Adverse effects of lead. Alternatives to lead ammunition.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Unit 11 (de 20): Contamination by other heavy metals and metalloids: mercury, cadmium, arsenic, selenium.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Unit 12 (de 20): Veterinary drugs: adverse effects on scavenger species. Diclofenac in Asian vultures, other anti-inflammatories and antibiotics.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Unit 13 (de 20): Toxins Toxiinfections food. Botulism. Cyanobacterial toxins: microcystins and other types. Mycotoxins	
Activities	Hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	4
Unit 14 (de 20): Biomarkers Determination of cerebral acetylcholinesterase activity in animals exposed to organophosphates and carbamates. In vitro reactivation techniques of enzymatic activity.	
Activities	Hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	4
Unit 15 (de 20): Analytical Toxicology Analysis of pesticides and poisons: solvent extraction, purification by gel permeation chromatography and analysis by gas chromatography coupled to mass spectrometry.	
Activities	Hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	4
Unit 16 (de 20): Analytical toxicology: Determination of anticoagulant rodenticides	
Activities	Hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	4
Unit 17 (de 20): Analytical Toxicology Heavy metal analysis: microwave oven digestion and atomic absorption analysis in graphite chamber.	
Activities	Hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	4
Unit 18 (de 20): Field study	
Activities	Hours
In-class Debates and forums [PRESENCIAL][project-based learning]	1.5
Writing of reports or projects [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	30
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	5
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	30
Problem solving and/or case studies [PRESENCIAL][Group Work]	12.5
Unit 19 (de 20): Experimental design.	
Activities	Hours
Study and Exam Preparation [AUTÓNOMA][Self-study]	30
Final test [PRESENCIAL][Problem solving and exercises]	1
Global activity	
Activities	hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
In-class Debates and forums [PRESENCIAL][project-based learning]	1.5
Writing of reports or projects [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	30
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	5
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	30
Problem solving and/or case studies [PRESENCIAL][Group Work]	12.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	30
Final test [PRESENCIAL][Problem solving and exercises]	1

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	City	ISBN	Year	Description
Beyer, W.N., Meador, J.P.	Environmental Contaminants in Biota: Interpreting Tissue Concentrations	CRC Pre	Boca Raton, FL		2011	
Elliott, J.E., Bishop, C.A., Morrissey, C.A.	Wildlife Ecotoxicology: Forensic Approaches	Springer			2011	
Hoffman, D.J., Rattner, B.A., Burton G.A., Cairns, J.	Handbook of Ecotoxicology	Lewis Publishers	Boca Raton, FL		2003	
Shore, R.F., Rattner, B.A.	Ecotoxicology of Wild Mammals	John Wiley and Sons Ltd	Chichester, UK		2001	