COURSE LAYOUT

1. GENERAL

SCHOOL	School of Animal Biosciences		
DEPARTMENT	Department of Animal Science		
STUDY LEVEL	Undergraduate		
COURSE CODE	237	**SEMESTER**	6th
COURSE TITLE	Analytical Toxicology - Xenobiotics		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**ECTS**
Course: Theory and Laboratory Practice (2+2)	4	4

COURSE TYPE (Foundation course, General knowledge, Scientific area, Developing skills)	Scientific area
PREREQUISITES	Principles of Organic Chemistry (2nd Semester Class)
LANGUAGE	Greek
IS THE COURSE OFFERED for ERASMUS STUDENTS?	No
COURSE WEB PAGE	https://mediasrv.aua.gr/eclass/courses/EZPY209/

2. LEARNING OUTCOMES

Learning Outcomes

Introductory course to analytical toxicology with emphasis on the study of various classes of xenobiotics residues detected in agricultural products and foodstuffs. Practical and theoretical tools for the evaluation of the risk assessment derived from xenobiotics presence.
In specific, during classes will be presented and discussed the
A) methodologies for the quantitative and qualitative determination of xenobiotics,
B) assessment of the consequences of human body exposure to xenobiotics,
C) mechanisms of their toxicity and absorption-metabolism by humans, animals and plants, and
D) importance of xenobiotics for agricultural production, economy, public health and the environment.
Among the large plethora of xenobiotics, special focus will be devoted to molecules used in agriculture either intentionally (Agrochemicals, growth hormones) and/or incidentally (medicines, toxins, heavy metals, permanent organic pollutants and natural products). The course will also cover the the mobility of xenobiotics in various media (soil, water, plant and animal tissues), their bioaccumulation process and degradation mechanisms.
Upon successful completion of the course, students are expected to know-understand the:

- main categories of xenobiotics along with their respective toxic actions.
- mechanisms of their toxic actions.
- absorption and metabolism-degradation mechanisms of xenobiotics in soil, water, atmosphere and tissues (plants, animals) for agricultural and natural ecosystems.
- basic assumptions utilized for the evaluation of the risk assessment derived from their presence in agricultural products in respect the economy, public health and the environment.
- basic methodologies-techniques used for the qualitative and quantitative detection of xenobiotics in soil, water and animal-plant tissues.
- existing legal Greek and European framework in respect the presence of xenobiotics in rural environments and be able to propose-apply appropriate implementing plans.

Finally, students have to produce a report-presentation for a class of xenobiotics concerning their toxicity, metabolism, mechanism of action and introduction into food chain, etc.

General Competences

Data analysis-synthesis, information mining. Application of relevant technologies
Adapting new situations
Work as individual
Teamwork
Working in a multidisciplinary environment
Respect the natural environment
Exercise criticism and self-criticism
Promotion of creative and inductive thinking

3. COURSE CONTENT

THEORY

- Categories of xenobiotics
  A. Persistent Organic Pollutants (POP)
  B. Heavy metals
  C. Toxins (aflatoxins, ochratoxins etc.)
  D. Residues-metabolites of plant protection products
  E. Hormones - Endocrine Disruptors (EDC's)
  F. Antibiotics, residues-metabolites of veterinary medicines
  G. PCB's, dioxins etc.
- Toxic mechanisms of various classes of xenobiotics. The mechanisms of genetic and acquired toxicities will be presented with particular focus on toxic reactions of liver and the heart and life support systems such as the reproductive, respiratory, endocrine, cardiovascular and cardiovascular systems.
- Mechanisms of diffusion, absorption and metabolism of xenobiotics. The process and techniques to calculate-evaluate the parameters of xenobiotics presence in soil, water, atmosphere and biological materials with emphasis on foodstuffs will be presented, along with the respective toxic impacts and assessment methodology in both rural and natural ecosystems.
- Basic principles and risk assessment methodologies. The basic principles of health risk assessment emerging from xenobiotic exposure will be presented. Specific study areas include risk identification techniques, evaluation of exposure to xenobiotics, dose response toxicity and risk characterization. Study of biomarkers and presentation of appropriate techniques and methods for statistical processing of the critical parameters.
- Basic principles for sampling and instrumental analysis of xenobiotics. Presentation and analysis of techniques for the extraction and isolation xenobiotics from diverse sources. Presentation of analytical instruments and techniques, with special focus on thin-layer, column, gas and high-performance liquid chromatographies, ultraviolet spectroscopy and mass spectrometry.
- Existing (Greek-European and International) legal framework. Presentation of the available best practices for the management of xenobiotics.
- Principles for literature research-documentation and writing-authoring scientific publications.

LABORATORY

Introduction

- Safety Guide for toxicology laboratory
- Management of hazardous materials.
- Laboratory equipment

Sampling

- Selection, sampling and handling of samples
- Macroscopic observation of samples

Sample preparation for toxicological analysis - Processing of a milk sample

- Protein precipitation
- Extraction using SPE

Colorimetric methods applications in Toxicology

- Ninhydrin reaction
- O-Cresol/ammonia reaction
- Dragendorff reaction
- Diphenylamine reaction

Spectrophotometric methods

- Quantitative assessment of urea in animal feed

Antibiotic Residues I (Qualification)

- Thin Layer Chromatography: Identification of tetracycline

Antibiotic residues II (Quantitative determination)

- HPLC Chromatography: Tetracycline quantitation

Assessment of volatile compounds with gas chromatography

- GC-MS determination of ethanol and methanol in sample

Literature assignment (individual-group) on modern methods of toxicological analysis

4. TEACHING and LEARNING METHODS - Evaluation

TEACHING METHOD	Face to face (theory-laboratory) and remote support via E-mail
USE OF INFORMATICS and COMMUNICATION TECHNOLOGIES	Power point presentations and video projections in lab lectures Learning process through e-class platform Communication with students via e-mail
TEACHING ORGANISATION (Lectures, individual or group assignments, field trips, individual study et.c.)	

Activities	***Workload per semester***
Lectures	26
Laboratory practices	26
Individual work	18
Teamwork	20
Case study	6
Study-analysis of book chapters and articles	4
Total contact hours and training	***100***

STUDENTS EVALUATION	**Theory** Teamwork (public presentation) 25% Individual work (public presentation) 50% Self and peers' evaluation of performance 12.5% Case study 12.5% **Laboratory** Written exam 65% Teamwork (public presentation) 15% Laboratory reports and experimental results 20%

5. LITERATURE

- **All lectures are available at *e-class* as *power-point* presentations**

Books:

- «Food Toxicology» (Greek) K. Giaginis, S. Thocharis, Xh. Karantonis, Ziti eds, Thessaloniki, 2015, ISBN 978-960-456-453-8
- «Veterinary Toxicology» (Greek) B.-P. Kotsaki-Kovatsi, Sichroni Paidia eds, 2004, ISBN 978- 960-357-064-8

Relevant books freely available in internet

- Basic Analytical Toxicology. 1995. World Health Organization, Geneva. pp 58. http://whqlibdoc.who.int/publications/1995/9241544589.pdf
- A Textbook of Modern Toxicology. 2004. John Wiley & Sons, Inc., Publication. pp 499. ftp://icksie.noip.org/EBooks/NBC/Chemical/A%20Textbook%20of%20Modern%20Toxicology.pdf

Related scientific journals

- Journal of Analytical Toxicology (http://jat.oxfordjournals.org)
- Journal of Agricultural and Food Chemistry (http://pubs.acs.org/journal/jafcau)
- Food and Chemical Toxicology (http://www.journals.elsevier.com/food-and-chemical-toxicology/)
- Toxicology (http://www.journals.elsevier.com/toxicology/)
- Toxicological Letters (http://www.journals.elsevier.com/toxicology-letters/)
- Toxicological Sciences (http://toxsci.oxfordjournals.org)
- Journal of Applied Toxicology (http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099-1263)
- Chemical Research in Toxicology (http://pubs.acs.org/journal/crtoec)
- Archives of Toxicology (http://www.springer.com/biomed/pharmacology+%26+toxicology/journal/204)