Environmental Pollution [316]

COURSE OUTLINE

(1) GENERAL

SCHOOL	ANIMAL BIOSCIENCES		
ACADEMIC UNIT	DEPARTMENT OF ANIMAL SCIENCE		
LEVEL OF STUDIES	Undergraduate [Major Elective]		
COURSE CODE	316	**SEMESTER**	7th
COURSE TITLE	ENVIRONMENTAL POLLUTION		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS (ECTS)**
Lectures	3	3
Total	**3**	**3**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific area
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS:	-
COURSE WEBSITE (URL):	https://oeclass.aua.gr/eclass/courses/EFP145/ http://efp.aua.gr/el/mathima/192

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Among the objectives of the course, students who successfully attend it are expected to:

• Understand the significance of major environmental issues in modern society.

• Gain a deep understanding of the causes and consequences of air pollution, soil pollution, freshwater pollution, and marine pollution.

• Acquire knowledge about the phytotoxicity of pollutants and their impacts, both biological and economic, especially on cultivated species.

• Familiarize themselves with methods of biological monitoring and assessment to evaluate disturbances, alterations, and stresses at the species, community, and ecosystem levels.

• Learn about the applications of bioindicators-biomonitors, with an emphasis on using plants to monitor environmental quality.

• Understand the methods of phytoremediation, which involve the use of plants in the purification and restoration of disturbed areas.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*

Working in an interdisciplinary environment *Production of new research ideas*	..... *Others...* .....

The course aims to develop the following general skills:
- Respect for the natural environment
- Design and project management skills
- Promoting work in an international environment
- Promoting work in an interdisciplinary environment
- Encouraging free, creative, and inductive thinking

(3) SYLLABUS

1. INTRODUCTION - General concepts of the biotic and abiotic Environment - The concept of Pollution - Definitions. Historical overview of pollution - Measurement units of pollution.
2. SOIL POLLUTION AND DEGRADATION - Heavy metal pollution - Nitrogen pollution - Radioactive pollution - Soil erosion - Desertification, causes and consequences with an emphasis on the consequences in agriculture.
3. WATER AND MARINE POLLUTION - Pollution from nutrient salts - Eutrophication phenomenon - Dissolved Oxygen - Biochemical Oxygen Demand (BOD) - Fertilizers, Pesticides (insecticides, herbicides, etc.), Pollution from waste microorganisms - Pollution from nutrient salts - Pollution from toxic metals - Bioaccumulation - Biomagnification. The case of mercury. Thermal pollution. Pollution from Organic substances (Chlorinated compounds - Petroleum). Accidents related to agriculture (Bhopal disaster, Seveso disaster, Rhine River accident). Pollution from ship accidents or offshore oil extraction systems - Remediation methods - Impacts on aquatic organisms.
4. ATMOSPHERIC POLLUTION. Sources of atmospheric pollution - Primary and secondary pollutants - Types of atmospheric pollution - Photochemical pollution (Los Angeles-type) - Smog pollution (London-type). Historically lethal episodes of atmospheric pollution - The case of London. Transfer of atmospheric pollution - Transboundary pollution - The grasshopper effect phenomenon. Urban pollution - The phenomenon of temperature inversion. The "smog" of Athens.
5. SIGNIFICANT ATMOSPHERIC POLLUTANTS. Carbon monoxide (CO) - Sources of CO, distribution of CO in the atmosphere - Effects of CO on plants and humans - toxicity limits. Nitrogen oxides (NOx) - Sources of NOx - distribution of NOx in the atmosphere - Effects of NOx on plants and humans - toxicity limits. Sulfur oxides (SOx) - Sources of SOx - distribution of SOx in the atmosphere - Effects of SOx on plants and humans - toxicity limits. Acid rain. Impact of acid rain on aquatic ecosystems - Effects of acid rain on plants, birds, cultural heritage. Ozone (O3). The ozone hole phenomenon - impacts - protection of the stratospheric O3 layer. Tropospheric O3 as a photochemical pollutant - formation - spatiotemporal variation. Impacts of O3 on human health. O3 as a phytotoxic pollutant - the AOT40 phytotoxicity index. Chlorofluorocarbons (CFCs) - Methyl bromide (MeBr) - Peroxyacetyl nitrate (PAN) - Volatile hydrocarbons (VOCs). Particulate pollution (PMS) - Impacts of particulate pollution on agriculture. Hydrocarbons. Mercury. Atmospheric oxidation - The role of hydroxyl radicals (OH).
6. CLIMATE CHANGE - THE "GREENHOUSE EFFECT" phenomenon. Climate forcing. Greenhouse gases. Carbon dioxide (CO2). Water vapor as a greenhouse gas. Methane (CH4) - Methane hydrates. Nitrous oxide or Nitrogenous oxide (N2O). Climate change and agriculture.
7. ENVIRONMENTAL QUALITY INDICATORS - BIOINDICATORS-BIOMETRICS for monitoring environmental quality. 8. PHYTOREMEDIATION - Bioremediation. Utilization of hyperaccumulator plants of metals.
9. ENVIRONMENTAL TOXICOLOGY - Ecotoxicology. Ecological risk assessment. The phenomenon of bioaccumulation in toxicology.

(4) TEACHING and LEARNING METHODS - EVALUATION

TEACHING METHOD *Face-to-face, Distance learning, etc.*	In the amphitheater
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint and video Communication with students through: • e-mail, • the e-class website, • the Open class platform, and • the announcements website of the Agricultural University of Athens:

TEACHING METHODS

The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	***Semester workload***
Lectures	39
Study hours and hours of self-directed study and exams preparation	36
Course total (25 h of workload per ECTS)	***75***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	I. The evaluation language is Greek. II. The grade in theory is determined either 100% by the final written exam or 20% by completing a project and 80% by the final written exam. III. Examinations may consist of short answer questions, multiple-choice questions, or mixed (i.e., multiple-choice questions + problemsolving or essay questions). IV. Oral examination is offered to those who prefer this method of examination for whatever reason (e.g., for health problems or any other reasons).

(5) ATTACHED BIBLIOGRAPHY

- University Textbooks:
"Environmental Protection Topics" - Author: Sotirios E. Tsiouris
"Principles of Environmental Chemistry" by James Girard - Edited by: M. Polysios, P. Tarantilis, X. Pappas. Scientific Editions Parisianou S.A.

The part of the material concerning Environmental Toxicology is covered by the textbook:
"Ecotoxicology and Environmental Toxicology" by Ath. Valavanidis, 2007. Edition: Department of Chemistry, University of Athens. It is freely available by the Author, in electronic form, at: https://service.eudoxus.gr/search/file/06/full-13317906.pdf

- University Notes:
Environmental Pollution (Author: C. Saitanis)

- Relevant scientific journals:
• Environmental Pollution
• Environmental Science and Pollution Research
• Environmental Monitoring