



UNIVERSITY "ISMAIL QEMALI" VLOR
FACULTY OF TECHNICAL AND NATURAL SCIENCES
DEPARTMENT OF BIOLOGY

APPROVED

Head of the Biology Department
Dr. Aurora BAKAJ

COURSE PROGRAM: ENVIRONMENTAL MICROBIOLOGY AND ECOTOXICOLOGY

Head/Teacher of the course:	Dr. Aurora Bakaj
Charge:	62 hours in total (26 hours lecture / 26 hours semester / 10 hours practice)
Subject typology:	Disciplines of the specialization training
Academic year/semester when it takes place:	2022 - 2023/ Fall 2022
Subject type:	Mandatory subjects
Study program:	Master of Science in Environmental Biology
Subject code:	BIO 523
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summary AND LEARNING OUTCOMES:

Environmental microbiology deals with the factors that affect the growth of microorganisms, temperature, pH, osmotic pressure. Radiation, impact of chemical agents on bacteria Sampling procedure. Elements of microbiology of water, food and soil are also analysed in this program. Ecotoxicology deals with the principles of environmental toxicology, the fields of toxicology. Classification of poisonous substances, stages of ecotoxicology; factors affecting toxicity, environmental toxic risk assessment. Distribution of toxins. Assessment of biotransport and bioaccumulation. Toxicology of sign organs Toxicology of halogenated compounds. Food Toxicology. Genetically modified organisms (GMOs). Bio-indicators and Bio-tracers. Water pollution, oil pollution.

BASIC CONCEPTS:

- 1 Water microbiology**
- 2 Soil microbiology**
- 3 Air microbiology**
- 4 Food microbiology**
- 5 Ecotoxicology**
- 6 Xenobiotic**
- 7 Biotransformation**

COURSE TOPICS:

Topics to be covered in the lectures:

- Topic 1** Introduction to Environmental Microbiology. History, modern developments of microbiology. Definition of environment. The cell wall of prokaryotes. For environmental makers. Microbial habitats. Microbial growth. Nutritional requirements. Inorganic nutrients, micro and macronutrients. Growth factors. Physical and chemical requirements for growth. Nutrient grounds. Culture of enrichment, pure culture.
- Topic 2** Microbial growth. Bacterial culture growth. Growth in limited culture, growth in continuous culture. Measurement of microbial growth. Direct and indirect methods of measuring microbial growth. Control of microbial growth. The pace of mortality. Physical methods of microbial control. Types of sterilization, disinfection, pasteurization, filtration, ionizing and non-ionizing radiation. chemical methods of microbial control. Types of disinfectants.
- Topic 3** Microorganism classification techniques. Taxonomy and phylogeny, domains. Methods of classification and identification of microorganisms. The use of phenotype in the identification of prokaryotes, biochemical tests, microscopic examination, staining techniques. Serology, use of genotype in identification
- Topic 4** Aquatic microbiology. Microbial habitats in aquatic environments. POM, DOM, primary, secondary production. Benthic habitats, biofilms. Freshwater environments, springs, rivers, streams, lakes and marine environments. Groundwater. The purpose of physical, chemical and biological water monitoring. Waste water treatment. Primary treatment, secondary treatment, tertiary treatment, septic tanks, Bioremediation
- Topic 5** Positive, negative microbial interactions. *Agrobacterium tumefaciens*. *Azobacter/Rhizobium* nitrogen fixation. Soil microbiology. Biotic and abiotic factors. Division into sections. The underground water system. Soil formation and soil composition. Factors of formation. Earth architecture. Earth's atmosphere. Soil as a microbiological environment. Soil structure and the role of microorganisms. Soil surface microorganisms. Distribution of microorganisms in soil, biogeochemical cycles
- Topic 6** Air microbiology. Important airborne pathogens that cause disease. Transmission of airborne microorganisms. Endo and exo toxins. Plant and human pathogens. Important toxins. The nature of bioaerosols. Aeromicrobiological pathway. Survival of microorganisms in air. Food microbiology. Food safety. Food microorganisms. Foodborne diseases, the most dangerous pathogens. Foodborne illness prevention. Preservatives and their classification.
- Topic 7** Introduction to ecotoxicology. Classification of xenobiotic substances. Classification of xenobiotic sources. Direct and indirect source, product and process as a source, accidental causes, mobile and stationary sources, regulated and unregulated sources. Effect on the environment, on land and water. Factors determining toxicity and modification of toxic effects
- Topic 8** Biotransformation of xenobiotics. The three stages of biotransformation. Detoxification process, metabolism, phases (biotransformation, conjugation).
- Topic 9** Xenobiotic degradation. In situ, ex-situ, Microbial bioremediation, in bacteria, in fungi in algae, phytoremediation and photoremediation,
- Topic 10** Toxic compounds produced by plants, animals, microorganisms. Toxicity indicators: DA 50, DE 50, DL50.

Topic 11 Ecotoxicology of pesticides, impact on humans, animals and plants. Processes of movement of pesticides in the soil: Diffusion, Evaporation, Absorption, Desorption.

Topic 12 Food Toxicology. Health consequences of plant and animal toxins. Toxicology of heavy metals. Genetically modified organisms (GMOs). Bio-indicators and Bio-tracers

Topic 13 Ecotoxicology of oil pollution. Environmental toxic risk assessment and assessment methods. (KILL)

Topics to be covered in laboratory work:

Topic 1 Collection and Storage of Water Samples

Topic 2 Water quality indicator parameters

Topic 3 Indicator microorganisms of water quality. Methods of isolation, identification and quantitative determination. Assessment of Microbial activity.

Topic 4 Water pollution and cleaning. Pollution from oil, pesticides, etc.

Topic 5 Collection and Storage of Air Samples

Topic 6 Air quality indicator parameters

Topic 7 Air quality indicator microorganisms. Methods of isolation, identification and quantitative determination. Assessment of Microbial activity.

Topic 8 Collection and Storage of Soil Samples

Topic 9 Indicator parameters of soil quality

Topic 10 Soil quality indicator microorganisms. Methods of isolation, identification and quantitative determination. Assessment of Microbial activity.

Topic 11 Collection and Storage of Food Samples

Topic 12 Indicator parameters of food quality

Topic 13 Indicator microorganisms of food quality. Methods of isolation, identification and quantitative determination. Assessment of Microbial activity.

FORM OF KNOWLEDGE CONTROL

control	Percentage assessment
Control I	10%
Annual assessment Seminars, laboratories, and teaching practice	10%
Final check	80%

ATTENDANCE:

The grading is based on the conversion of the total grade into %, grade 5-10 progressively 40-100%. The student, who results in less than 75% attendance for the period that belongs to each partial exam, the period for which he will be tested, will not be included in the relevant exam, will be evaluated with M.

If the student has attended the course, but does not appear in the next exam, he is assessed NP (Did Not Appear).

COURSE FORMAT:

The subject will be evaluated on the basis of two partial exams, assignments and the final exam. Points earned will be cumulative. The exams will not be repeated, for any reason. If you miss an exam without any major reason, then you will lose points for that exam that you did not appear for.

LITERATURE

a)Mandatory basic literature:

1. Series of lectures by Dr. Aurora Bakaj

b) Recommended literature:

Aurora Bakaj: Series of lectures Etleva Hamzaraj, 2007: General Microbiology. Gianni Dehò, Enrica Galli, 2014: Biologia dei microorganismi. Marco Vighi, Eros Bacci. 2004. Ecotoxicologia Ferdi Brahushi. 2015. Organic pollutants and ecotoxicology.

Lecturer
Dr. Aurora BAKAJ