Study Programme : MSc in Ecology

Degree level: **Master degree**

Course Title: BIOTRANSFORMATIONS

Professor: Dr. Milan Matavulj

Elective Course

Number of ECTS: 6

Prerequisites: Credit points of Bachelor degree (Chemistry, Biochemistry, Microbiology, and Microbial Ecology)

Course Objective: A course designed to acquaint students with biology, role and significance of microorganisms in matter cycle in natural environments, in biotechnological use, as well as in environmental protection. Emphasis will be placed on microbial enzyme activity research, their metabolism as the basis of natural matter cycle and energy flow through ecosystem.

Course Outcome: Enabling students to understand the role of microorganisms in processes of matter cycle in nature, and their significance in biotechnological processes. Also enabling them for independent and individual research work: experiment design, results recording, analysis, interpretation of results, elaboration and presentation, eventually use of new experience in conducting simple experiments related to the specific interrelationship of microorganisms with other organisms; to explain the role of microorganisms in biotechnological processes and in natural environments: bioconversion of by-products of agricultural and industrial production into high-value products; bioconversion of xenobiotics into nontoxic compounds.

Course Content:

Theoretical part: Students get acquainted with general characteristics of microorganisms, especially as producers of extracellular and intracellular degradative enzymes, with their significance in biodegradation of natural and anthropogenic waste materials and their bioconversion into high-value products (bioconversion of straw into sugars and alcohol; fermentation carbohidrates into alcohol or organic acids and antibiotics; anaerobic bioconversion of waste materials into biogas; production of single-cell proteins; bioconversion of precursors into active hormons; provitamines into vitamines; bioconversion of high-toxic xenobiotics into low-toxic or nontoxic, etc. Biotechnological processes as the basis of non-green revolution expected in this century. Production of food, pharmaceuticals and energy, based on heterotrophic activity of bacteria, fungi and other heterotrophs. Saprotrophism as the basis of function of wastewater purification plants, production of biosynthetic ecologically friendly plastic materials, and bioremediation processes and methods.

Practical part: Developing competence in cultivation of microorganisms. Principles of experimental work: the best sampling practice, inoculation on solid media and cultivation procedure. Developing skills in results recording procedure. Getting knowledge in methods of purification of bacterial isolates. Conservation for culture collection and learning rules and procedures for culture maintenance. Through the practicals, students get acquainted with physiological characteristics of isolated cultures of microorganisms. Cultivation with the aim of optimization of microbial growth in different experimental conditions in order to understand microbial (eco)physiology (enzyme activity: hydrolase, esterase, protease, lypase, saccharase, cellulase, etc.) as the basis of biotransformations. Microbial degradation of phenolic compounds, oil derivatives, polycyclic aromatic hydrocarbons, pesticides, what is in the basis of biodegradative processes used in environmental protection technology. Biomass and biogas biosynthesis.

Reading List:

1. Pejin D (2003): Industrial Microbiology, University of Novi Sad, Faculty of Technology (In Serbian).
2. Radnović D, Matavulj M, Karaman M (2007): Mycology. Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad and WUS (In Serbian)
3. Alexander M (1994): Biodegradation and bioremediation. Academic press.
4. Betts WB (editor) : Biodegradation: natural and synthetic materials. Springer series in applied biology.
5. Chaudhry GR(1994): Biological Degradation and Bioremediation of Toxic Chemicals. Chapman & Hall, London.
6. Matavulj M (2011): Lecture outlines and power-point presentations (In Serbian and in English)
7. Madigan MT, Martinko JM (2006): Brock Biology of Microorganisms. Prentice Hall, Pearson Education Internat. (In English)

Total hours:

Lectures: **2**	Practicals: **2**	Other:	Student research work: **5**	

Methods of instruction: lectures, practicals, consultations, seminars, colloquia, visiting water purification plant

Assessment (maximum number of points 100)

Requirements	**points**	**Final exam**	**points**
Active participation in lectures	5	Practical exam	15
Colloquia (Pre-exam tests)	40	Oral exam	40

Remark: - Students will develop a deeper understanding of experimental work in microbiological laboratory through independent study. Part of the learning material will be available on the internet.