**Study Programme : PhD in Ecology**

Degree level: Doctoral degree

**Course Title: Polluted waters**

**Professor: Jelica Simeunovic**

**Required/Elective Course: Elective**

**Number of ECTS: 15**

**Prerequisites:**

**Course Objective:**

Familiarization with metabolical diversity of microorganisms, particularly bacteria and their role in processes of biodegradation of organic pollutants, as well as their interactions with other pollutants (oil, phenols, pesticides, heavy metals). Role of autochthonous microorganisms as a basis of biological processes of purification of polluted waters (activated sludge, biological filtration, water plants). Problem of filamentous bacteria in activated sludge. Legislative in the field of polluted waters.

**Course Outcome:**

The course will provide knowledge about basic biological and microbiological characteristics of polluted waters, their purification, microbial communities and their active participation in the processes and their application as bioindicators.

**Course Content:**

*Theoretical part*

Hydrological water cycle in natural environment and problem of polluted waters. Microorganisms as indicators of water pollution and their active participation in water purification. Methods and techniques for detection of some groups of microorganisms. Biological characteristics of wastewaters and application of microorganisms in biological purification procedures- water lagoons, activated sludge, activated carbon. Aerobic and anaerobic processes. Main characteristics, definition, structure, flocculated and granulated activated sludge. Nitrificators and denitrificators in metabolism of nitrogen compounds in wastewaters. Filamentous bacteria and phenomenon of sludge bulking; problem solution. Biological filtrations- biodiscs. Biofilms of activated carbon in tertiary process of wastewaters purification. Electron microscopy; legislative.

*Practical part*

**Reading List:**


Baras J., Brković-Popović I., Knežić L.,Popović M., Blagojević N. (1979): Obrada otpadnih voda.II deo – biološka obrada.Savez hemičara i tehnologa Srbije, Beograd.

Seviour R.J.,Blackall L.L. (1999): The Microbiology of Activated Sludge. Kluwer Academic Publishers.London.

Popović M., Brković-Popović I. (1968): Studija postupaka prečišćavanja industrijskih otpadnih voda u svetlu literaturnih podataka.ITEN, Sarajevo.

Popović M., Krsmanović G., Brković-Popović I. (1968): Prilaženje problemu tretiranja industrijskih otpadnih voda – metodologija rada.ITEN, Beograd.

Gaćeša S., Klašnja M. (1994): Tehnologija vode i otpadnih voda. Jugoslovensko udruženje pivara, Beograd

Cloete T.E. , Muyima N.Y.O. (1997): Microbial Community Analysis – The Key to the Design of Biological Wastewater Treatment Systems. Scientific and technical Report No.5

Božena Tušar (2004): Ispuštanje i pročišćavanje otpadne vode s zakonskom regulativom. Croatiaknjiga, Zagreb.

Eikelboom H.D. (2000): Process Control of Activated Sludge Plants by Microscopic Investigation. IWA Publishing, London.


| **Total hours:** | | | | |
|---|---|---|---|---|
| Lectures: 5 | Practicals: | Other: 5 | Student research work: | |

**Methods of instruction:** ПП презентације, консултације, презентација семинарских радова
PP presentations, consultations, presentations of seminar papers

**Assessment (maximum number of points 100)**

**Requirements**

**Seminar papers: 30** **Oral exam: 70**

**Remark:**