COURSE ID SHEET

Course No.	5175	NTUA

Semester:	8,10	Core		Elective		Specialization	X

Title: **ENVIRONMENTAL BIOTECHNOLOGY**

Aim: Students will be familiarized with: i) the bioprocesses that aim both at the environmental protection of ecosystems from pollution and at the utilization of liquid and solid wastes for the production of high added value products; ii) the design and optimization of these biological systems.

Content:

- **Ecosystems.** Microorganisms (bacteria, fungi, protozoa). Aerobic and anaerobic biological systems. Life cycle of carbon, nitrogen, sulfur, phosphorus, iron. Environmental pollution. Eutrophic pollution - toxic pollution. Attention to Anti-pollution Technologies. Clean Technologies - Recycling Technologies. Environmental significance of microorganisms.
- **Biological stabilization of organic substrates.** Kinetic microbial growth. Structured models of microbial growth. Mixed microbial systems. Inhibitory and competitive growth factors of mixed microbial systems. Thermodynamic equilibrium of ecosystems. Effects of environmental bio-reactions. Aerobic, anaerobic and facultative biological systems. Aerobic and anaerobic degradation (digestion) of liquid waste. Aerobic digestion of solid waste (composting).
- **Bioreactors for stabilizing organic liquid waste.** Continuous and batch systems of active sludge, biofilters of fixed and non-fixed heterogeneous substrate. Anaerobic biological sludge granular reactors (UASB, EGSB, SGASB reactors). Design of biological treatment units. Biofilters for degradation of gaseous pollutants.
- **Natural ecosystems for wastewater treatment.** Hydroponic crops of aquatic plants. Aerobic - anaerobic lagoons. Basic principles and methods (in situ and ex-situ) phyto-remediation and bio-remediation of contaminated soils and wastewater containing toxic compounds (e.g., pesticides, PAHs, PCBs).
- **Biological nitrogen removal, Nitrification-denitrification.** Advanced methods of nutrient removal (CANON, SHARON, BABE, etc.). Biological removal of phosphorus. Biological removal of heavy metals (arsenic, cadmium, chromium, copper, mercury). Biological removal of radioactive materials. Biological removal of radioactive materials (uranium, thorium, uranium) by bio-absorbance.
- **Microbial production of high added value products from wastes** such as enzymes, biofuels, bio-polymers, biosurfactants under the concept of biorefineries.

Hours per semester:

LECTURES	24	EXERCISES	-	LABORA-TORY	16	HOME-WORK	135	**TOTAL HOURS: 175**

Student performance/ evaluation:

The evaluation of the students will be done through:

- A Final (written) Examination (FE), using books and notes, and
- Laboratory Exercises (LE).

The Final Grade results as follows: Final Grade = 0.5 x (FE) + 0.5 x (LE)