COURSE ID SHEET

Course No.	5307	NTUA

Semester:	9	Core		Elective		Specialization	X

Title: **BIOENGINEERING**

Aim:

The aim of the course is to give students of the School of Chemical Engineering a presentation of basic principles, methods and applications in Biotechnology and Biomedical Engineering and the latest scientific achievements in this field and to highlight the need for Chemical Engineering to be involved in an interdisciplinary field, at the crossroads of Biology, Medicine and Engineering. There will be a brief presentation of basic knowledge that is the foundation for the development and understanding of Biotechnology / Biomedicine as well as modern experimental methods / tools in the hands of Biotechnology and Biomedical Engineering.

Content:

The content of the course is divided into two main thematic units. The first section presents basic principles of genetic engineering (eukaryotic cells and their organelles, the similarities and varieties of eukaryotic and bacterial cells, model organisms and techniques used for the research of biological problems and applications).

Content:

- Introduction to Biomechanics. Biotechnology and Biomedical Engineering (definitions, relationship of Chemical Engineer with classical and modern Biotechnology)
- How cellular information changes (Mutations, Mechanisms of gene transfer, Genetic engineering of cells, Genomics)
- Experimental methods of Genetic Engineering (restriction enzymes, vector recombination, cloning-expression vectors, heterologous protein expression strategy)
- Use of genetically modified microorganisms (Introduction, Selection of host-vector system, Process-related plasmid design, Metabolic Engineering, Protein Engineering)
- Experimental Methods of Genomics (Methods for DNA sequencing, silencing and gene removal, mRNA and protein detection)
- Bioinformatics (Introduction to Molecular Biology, Databases, Sequence Alignment / Comparison and Phylogenetic Tree Construction)

The second section introduces an introduction to Biomedical Technology with examples of cellular function (function of membranes and ion channels of nerve cells and their role in signaling) or at tissue level (function of the cardiovascular system and regulation of flows and pressures in heart and vessels, mechanical properties of biological tissues).

Indicative List of Laboratory Exercises:

1) Metabolic pathway simulations with COPASI (Metabolic Engineering)
2) Imaging protein models with the PyMOL program (Protein Engineering)
3) Bioinformatics Exercises

Hours per semester:

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

Student performance /evaluation:	The evaluation will be done: • Through a Final Examination, including theory and solving of exercises without the use of books or notes. • Through a Bibliographical Assignment, including the writing and presentation of a review of modern subjects regarding Biotechnology and Bioengineering. • Through Laboratory Exercises, as it follows from the attendance in each exercise, the individual answers and the grade of the Final Laboratory Examination. **The final grade results as follows:** **Final Grade = 0.6x(final examination) + 0.2x(bibliographical assignment) + 0.2x(laboratory exercises)**