BME 5000 Intro to Bioengineering

Credits: 3 credits

Textbook, Title, Author, and Year: Biomedical Engineering © Mark Saltzman, Cambridge texts in Biomedical Engineering, 2009

Reference Materials: Bernard O. Palsson and Sangeeta N. Bhatia, Pearson Education, Inc., Prentice Hall, NJ, (1st Edition) 2004

Specific Course Information

- **Catalog description:** The emphasis of the course is **on introduction into complexity of biological systems and integrative solutions to the problems:** *the physico-chemical, structural, and mathematical principles* of cell and tissue/ organ functions. The course does not only give students basic knowledge on cell and organ functions, but introduces principles of bioengineering: drug & gene delivery, other agent's delivery, enzyme, abzyme and receptor kinetics, stem cell status of fundamental and applicable knowledge, and regenerative and organ therapy, artificial organs and stem cell transplantation therapy and bioengineering, biomaterials and nanotechnology, in order to give the basis for more advanced courses such as Tissue Engineering.
- **Prerequisites:** Prerequisites: Permission of the Instructor. Prior Biology or Biomedical related Courses are acceptable, but not necessary.

Specific Goals for the Course:

During the course students will not only *learn and study particular topics,* but also *try to give the solutions to certain problems in order to develop their creativity and talents* for advanced more complex and independent integrative thinking and research. The ultimate purpose of the study is to not only give the knowledge on this already advanced in its development, complex, and highly progressing field of research, but to encourage students toward a modern, cotemporary integral approaches, with their own creative ideas directed to bio (*life science*) *medical* fields at both molecular, and integral physiological level, involving them into particular, chosen thematic research fields, so that they can articulate their own ideas for master and-or PhD theses.

Brief List of Topics to Be Covered:

1. Examples of biological systems from bioengineering point of view: mathematical models important for understanding and supporting biological functions (skeleton, circulation)
2. Cell construction and housekeeping functions (concept of motor proteins)
3. The technology behind human genome project (computational approach to determination of the role of micro-RNA in diseases, Lab-on chip methodology for research and clinical practice)
4. Enzyme/Abzyme (antibody as a hydrolytic enzyme) and Receptor Function and Kinetics (computational modeling)
5. Stem cells and tissue engineering: principles of regenerative and organ replacement therapy
6. Diseases as the models for regenerative therapy (transplantation)
7. Drug delivery systems, including viral gene delivery
8. Artificial organs
9. Nanotechnology: nanorobot and nanobrain-concepts