Course Title: CHEM E/BIOENG 467

UW General Catalog Course Description;
Application of basic chemical engineering principles to biochemical and biological process industries such as fermentation, enzyme technology, and biological waste treatment. Rapid overview of relevant microbiology, biochemistry, and molecular genetics. Design and analysis of biological reactors and product recovery operations.

Instructor: Baneyx, François

Instructor's Course Description:
The first part of the course introduces engineering students with little background in biology to fundamentals of biochemistry, molecular biology and genetics with an emphasis on the production of recombinant proteins and small metabolites. The second part of the course focuses on biochemical engineering aspects and covers sterilization, chemostat theory, bioreactor instrumentation, mass transfer effects in immobilized systems and protein purification.

Prerequisites:
CHEM E 340; either CHEM 223, CHEM 237, or CHEM 335; recommended: CHEM E 465.

Textbook:
None – notes and web-based reading provided at
http://faculty.washington.edu/baneyx/467/467.html

Course Objectives:

- Understand and use basic biology, biochemistry, molecular biology and genetics principles
- Apply kinetics and reactor theory to biological systems and processes
- Learn unit operations used in the recovery of biological products

Topics covered:

1. Microbial diversity, basic biology 2. Carbohydrates, lipids 3. Proteins, enzymes and enzymatic kinetics 4. Nucleic acids 5. Gene expression and regulation 6. Mutations 7. Genetic engineering 8. Energetics and stoichiometry 9. Sterilization 10. Cell growth 11. Chemostat theory and bioreactor design 12. Immobilized cells and enzymes 13. Biosensors 14. Product recovery.

Class schedule:
Lectures 1hr20min/lecture, meet twice a week

Computer use:
Homeworks

Laboratory Project:

N/A

Design Project:
N/A

Course Outcomes and Assessment:
CHEM E/BIOENG 467 presents, in interactive lectures and assignments, the contemporary field of applied molecular biotechnology and biochemical engineering. As such, this course addresses certain ABET outcome criteria at a variety of levels.

(f) An understanding of professional and ethical responsibility. Future professional and ethical issues related to each scientific topic covered will also be discussed briefly in lecture; certain homework assignments will reinforce the need to recognize professional responsibilities.

(h) To understand the impact of engineering solutions in a global and societal context. The impact of molecular biotechnology issues on a local and global scale will be discussed briefly in appropriate lectures; certain homework assignments will reinforce the need to consider political/societal aspects of certain biotechnologies.

(j) Knowledge of contemporary issues. By the basic subject matter of the course, each topic will be timely. Homework exercises to locate lay newspaper articles or popular scientific magazine articles related to class topics.

(l) An understanding of biology and physiology. The entire course comprises contemporary topics in bioengineering aspect of molecular biology. Acquisition of this information will be assessed by homeworks and retention determined by strategic questions on exams.

(e) An ability to identify, formulate, and solve engineering problems. Course presents various industrial scale aspects of molecular biology in lectures, homework, and exams requiring students to combine their knowledge of biology with reactor design, kinetics and product recovery to design real scale engineered systems.

Relationship of Course to Departmental Objectives:
The course serves to introduce CHEM E/BIOENG 467 students to contemporary applied molecular biotechnology. Students are first exposed to the underlying biology/biochemistry concepts and those topics are then placed in the context of current and future industrial practice. CHEM E/BIOENG 467 differs from a molecular biology survey course in that all topics are

presented in lectures within an engineering context. For example, not only are the basics of protein synthesis presented but also the engineering principles required to design industrial-scale production facilities are given. Fundamentals of recombinant DNA genetics are provided along with reactor design principles used in practice. Integrating biological fundamentals and engineering practice is accomplished throughout the course by specific lectures, homework problems employing material balance and mass transfer mathematics, computer simulations, and case study journal article critiques.

Thus, CHEM E/BIOENG 467 complies with departmental objectives by:

Coupling mathematics, engineering, and biology.

Developing an ability to communicate problems and their solutions effectively with physicians, biologists, and other engineers

Take ethical and social issues into consideration in solving bioengineering problems (lectures, homework)