

Course Title: Bioen 491 –

UW General Catalog Course Description:

Mechanisms for controlled release of active agents and the development of useful drug delivery systems for this purpose. Release mechanisms considered include diffusive, convective, and erosive driving forces. Delivery routes include topical, oral and in vivo. Some special case studies covered in detail.

Instructor: Pun, Suzie H.

Instructor's Detailed Course Description:

Bioen 491 – (3 credits). This course is designed to provide students with an understanding of the principles, strategies, and materials used in controlled drug delivery systems. The course will first cover the fundamentals of drug delivery, including physiology, pharmacokinetics/pharmacodynamics, drug diffusion and permeation, and biomaterials used in drug delivery. Controlled release strategies for various administration routes will then be discussed. The course will conclude with special topics lectures on targeted drug delivery, gene delivery, vaccine delivery, and protein delivery from UW faculty and industry guest lecturers.

Prerequisites by Topics:

Organic chemistry, physical chemistry, transport phenomena

Textbooks:

"Drug Delivery: Engineering Principles for Drug Therapy". Mark Saltzman, Oxford University Press, 2001 ISBN: 0195085892

"Drug Delivery and Targeting". Eds Anya M. Hillery, Andrew W. Lloyd, James Swarbrick. Taylor and Francis, 2001. ISBN 0415271975

Course Objectives:

This course introduces upper division undergraduates in Bioengineering, Chemical Engineering and Chemistry to principles used in designing controlled drug delivery systems. Students will learn basic principles in pharmacology, drug transport, and biomaterials used in drug delivery. The students apply this knowledge in a final team-based design project.

Topics Covered:

1. Basic pharmacology (PK/PD) 2. Diffusion in biological systems 3. Drug permeation and transport 4. Biomaterials and modulation of drug activity 4. Drug administration methods 5. Macromolecule drug delivery 6. Targeted drug delivery 7. Intellectual property issues in drug delivery

Class Schedule:

- Lectures 1hr20min/lecture, meet twice a week

Computer Use:

Students will use computers to prepare their homework, final papers and class presentations.

Laboratory Projects:

N/A.

Design Project:

A final term paper is required. Students will work in small groups to prepare a project design proposal that is generally 10-15 pages in length. The proposal will focus on the development of a novel controlled drug delivery system for an application specified by the instructor and will include a background section defining the current state of the art and remaining need for improvement, design criteria for an improved system, a novel delivery system designed to meet the defined needs, and assessment methods for meeting the design criteria. In addition, effective proposals will include an economic assessment and discussion of societal impact of the proposed system. Students will also give a 15 minute oral presentation of their paper in class with a 5 minute question/answer period. The final paper and presentation will be worth 30% of the class grade.

Course Outcome and Assessment:

Specific outcomes in Bioen 491 and their assessment mechanisms to be used by the department for **program assessment** are:

(c) *an ability to design a system, component, or process to meet desired needs.* Students' ability will be assessed by their final project, in which they will design a controlled release system for a specified application. Students will also be assessed in examinations, where they will be asked to analyze the design of published systems based indicators such as drug release kinetics.

(g) *an ability to communicate effectively.* Written communication will be assessed by homework, exams, and final papers. Some homework and exam questions will require interpretation and analysis of published journal articles. Oral communication will be assessed by in-class presentations of their final projects.

(j) *knowledge of contemporary issues.* Students will be evaluated on their understanding of economic and societal forces driving drug delivery development through homework and exams. Students will also be evaluated on their knowledge of current state-of-the-art drug delivery vehicles through their final projects.

Additional outcomes and their assessment mechanisms considered of **high relevance** to ABET criteria by the department for Bioen 491 are: none

Those specific outcomes and their assessment mechanisms considered of **medium relevance** by the department for Bioen 491 are:

- (d) *Teamwork* In one set of the homework assignments and their final project, students form their own teams to complete the assignment. Final projects will be completed in teams of 2-4 students, with co-authored reports and team presentations.

Relationship of Course to Departmental Objectives:

Bioen 491 is designed to introduce controlled drug release systems to upper division undergraduates and graduate students. The course reflects in the interdisciplinary science of drug delivery by covering basic pharmacology, mass transport of drugs through diffusion and permeation, the chemistry of materials used in drug delivery systems, and economic and intellectual property considerations in pharmaceutical industries. The course also includes guest lecturers from industry who provide perspective on current development and application of drug delivery devices. Through this training, the students are expected to design and evaluate novel drug delivery devices for specified applications.

In summary, Bioen 491 complies with the departmental objectives by:

- applying students' knowledge in physics, chemistry, engineering and biology to design and solve biomedical problems.
- strengthening students' ability to communicate through written and verbal media
- providing opportunities for students to work in multidisciplinary teams