AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF ENGINEERING AND ARCHITECTURE

The Engineering of Drug Delivery Systems
BMEN 604 / CHEN 673
Fall 2021-2022

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1. Course Administration

Instructor: Prof. Rami Mhanna
Office: 404 – RGB Bldg.
Phone: x 3635 (calls during office hours only)
Office hours: M 17:00-18:00 or by appointment
Email: rm136@aub.edu.lb

2. Course Description [3 credits]

This course focuses on recent advances in the development of novel drug delivery systems. The fundamentals of drug delivery are discussed. Various strategies to tune and control the release of active agents for optimized therapeutic outcomes are explored. The course covers polymers and techniques used to produce drug nanoparticles, with specific examples of nanoparticle-based drug delivery systems.

3. Time and Place

TR 15:30 – 16:45 [Duration: August 29 – December 19]
BCTL 202 – Online via Webex

4. Prerequisites

CHEM 204: General Chemistry for Engineers
CHEN 314 Chemical Engineering Thermodynamics
CHEN 411: Heat and Mass Transfer Operations (or equivalent)

5. References

- Material will be selected form book chapters, review articles and research journals
- W. Mark Saltzman. Drug Delivery: Engineering Principles for Drug Therapy. Oxford University Press, New York, 2001.

6. Educational Objectives

1- Address issues relevant to drug delivery
2- Develop an understanding of the concepts and materials used in controlled drug delivery
3- Introduce fundamental principles behind drug diffusion
4- Present methodologies used to optimize the delivery of therapeutic agents, with focus on nanoparticle and liposome-based approaches.

5- Provide an overview of the nature and characteristics of lipids and polymers used in drug delivery
6- Familiarize students with recent advances in drug delivery and novel approaches in the development of controlled drug delivery formulations
7- Develop communication skills through written and oral presentation of a topic of interest related to the course subject

7. Course Topics [equivalent of around 1 week per topic]

I. Introduction to engineering drug delivery systems
II. Classical immune response and targeting
III. Micro/nanoparticle-based drug delivery
IV. Polymer use in drug delivery
V. Liposomes for drug delivery applications
VI. Matrix and implantable drug delivery devices
VII. Vaccines and their delivery
VIII. Drug delivery applications (e.g. in the context of tissue engineering)
IX. Drug diffusion and permeation
X. Drug distribution, degradation and clearance (pharmacokinetics).
XI. Conventional drug candidate formulation development approach
XII. Drug toxicology and pharmacology
XIII. A look into the future of drug delivery

8. Learning Outcomes:

By the end of the course, students should be able to:
1- Describe the concept of drug delivery
2- Explain fundamental principles of drug diffusion together with engineering technologies and their relation to drug delivery applications
3- Explain the interdisciplinary nature of drug delivery and describe state of the art drug delivery systems
4- State examples of materials used to construct drug delivery systems
5- Analyze literature related to drug delivery
6- Design a targeted drug delivery system to treat a certain disease

9. Student Assessment

Major Assignment	**30%**
Quizzes/Minor Assignments	**20%**
Research presentations	**20%**
Final exam	**30%**

10. Resources

Students are expected to check for updates on Moodle on a daily basis. Announcements, course handouts, and assignments will be available in “pdf” format from Moodle.

11.Students with disabilities

AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform me immediately so that we can privately discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodations process, you are encouraged to contact the Accessible Education Office: accessibility@aub.edu.lb; +961-1-350000, x3246; West Hall, 314'.