

## **Biomaterials for Drug Delivery**

BME 4648 Section3A22

**Class Periods:** T, Period 7 (1:55-2:45pm) and R, Period 7-8 (1:55-3:50pm),

**Location:** Zoom

**Academic Term:** Spring 2021

### **Instructor:**

Blanka Sharma

[blanka.sharma@bme.ufl.edu](mailto:blanka.sharma@bme.ufl.edu)

352-273-9329

Office Hours: Tuesday 2:45-4:00pm (tentative)

### **Teaching Assistants:**

None

### **Course Description**

This course focuses on the principles of engineering controlled release systems, and integrates topics in polymer chemistry, biomaterials, pharmacokinetics/pharmacodynamics, and mass transport phenomena. 3 Credits.

### **Course Pre-Requisites / Co-Requisites**

BME3060(C), BME4632

### **Course Objectives**

1. Apply engineering principles to the design of controlled release and drug delivery systems.
2. Understand the biomaterials used in the engineering of drug delivery systems for various applications.
3. Evaluate and critique current literature on drug delivery technologies.

### **Materials and Supply Fees**

None

### **Professional Component (ABET):**

N/A

### **Relation to Program Outcomes (ABET):**

<b>Outcome</b>	<b>Coverage*</b>
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3. an ability to communicate effectively with a range of audiences	Low
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Low
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Low

\*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course

### **Required Textbooks and Software**

Title: Drug Delivery: Fundamentals and Applications, Second Edition  
Second Edition  
Authors: Anya M. Hillery, Kinam Part  
Publisher: CRC Press, Taylor and Francis  
ISBN: 9781482217711

Note: Older version of this text is also acceptable.

Title: Drug Delivery and Targeting: For Pharmacists and Pharmaceutical Scientists.  
Authors: Anya M. Hillery, Andrew W. Lloyd, James Swarbrick  
Copyright date:2001  
Publisher: Taylor and Francis  
ISBN: 9780415271981

Course notes are derived primarily from both the required and recommended textbooks listed. Some course notes are derived from published review articles, and will be provided to students accordingly.

### **Recommended Materials**

Title: Engineering Principle of Drug Delivery  
Author: Mark Saltzman  
Copyright Date: 2001  
Publisher: Oxford University Press  
ISBN: 0-19-508589-2

### **Course Schedule**

**\* Note this is subject to change at instructor's discretion.**

- Week 1: Course Overview, Introduction to Controlled Drug Delivery, Pharmacokinetics/Pharmacodynamics (Hillery Ch. 1-3)
- Week 2: Introduction to Controlled Drug Delivery, Pharmacokinetics/Pharmacodynamics (Hillery Ch. 1-3, Saltzman Ch. 7)
- Week 3: Diffusion in Biological Systems (Saltzman Ch. 2-4, Hillery Ch. 3)  
QUIZ 1 (Pharmacokinetics/Pharmacodynamics)
- Week 4: Polymers in Drug Delivery Systems (Saltzman Ch 9-10, Appendix A2. Hillery Ch 4-5)
- Week 5: Bioresponsive polymers for drug delivery  
QUIZ 2 (Engineering Controlled Release Systems)
- Week 6: Parenteral Drug Delivery Systems (Hillery Ch. 4-5, Saltzman Ch. 9-10)
- Week 7: Parenteral Drug Delivery and Drug Targeting/Nanomedicine (Hillery Ch. 5)  
MIDTERM EXAM
- Week 8: Gene/Nucleic Acid Delivery (Hillery Ch. 14)
- Week 9: Cells as Drugs and Drug Delivery Systems  
QUIZ 3 (Parenteral DD and Nanomedicine)
- Week 10: Oral Drug Delivery (Hillery Ch. 6)

Week 11	Transdermal Drug Delivery (Hillery Ch. 8)
Week 12	Pulmonary Drug Delivery (Hillery Ch. 10) Quiz 4 (Routes of Drug Delivery)
Week 13	*Student Presentations
Week 14	*Student Presentations
Week 15	Exam Review

FINAL EXAM: 4/29/2021 @ 3:00 PM - 5:00 PM

\*Students will present key findings from a literature review on an approved drug delivery topic and in-depth analysis on one paper related to this topic.

### ***Online Course Recording***

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Students are expected to attend course lectures and participate in class discussions. It is expected that there will be no cell phone or electronic device distractions in class. If you are unable to attend class, will be coming late or leaving early, then you are expected to inform the instructor. Students are expected to be in class, prepared to learn, engaged, and overall contributors to the learning environment. Poor attendance will affect your participation grade.

**Unless prior arrangements** have been made with the instructor, students will be deducted 15% per day for late coursework, with deductions occurring at the time associated with the due date. Unless prior arrangements have been made with instructor, missed exams will receive a grade of 0pts.

While students are encouraged to discuss course material and assignments together outside of class, it is expected that all coursework/assignments submitted is the students' own work.

### ***Evaluation of Grades***

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Homework Sets	100 each	15%
Quizzes	15-30 each	10%
Midterm Exam	100 each	20%
Final Exam	100	30%
Term Project	100	15%
Participation	100	10%

		100%
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### **Grading Policy**

The following is given as an example only.

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
90.0 - 100	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 - 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 - 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:  
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

### **Students Requiring Accommodations**

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### **Course Evaluation**

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

### **University Honesty Policy**

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### **Plagiarism**

Plagiarism is a common infraction to the UF Honor Code. If you are confused as to what constitutes plagiarism, see here: <https://guides.uflib.ufl.edu/copyright/plagiarism>. Plagiarism on any of your assignments **will be reported to the Dean of Students as a UF Student Honor Code violation**. Also, note that **copying solutions for any assignment, regardless of the source (e.g. other students, pirated website solutions), will be treated as plagiarism**. If you have any questions or concerns, please consult with the instructor in this class. Note that failure

to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

### ***Campus Resources:***

#### *Health and Wellness*

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

## Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus**: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints**: <http://www.distance.ufl.edu/student-complaint-process>.