

Phar 6718 DRUG DELIVERY II

Term: Spring 2020

Dates: January 15 - May 8, 2020

Schedule:	M 9:05 – 9:55 AM	W 9:05 – 9:55 AM	F 10:10 – 11:00 AM
Twin Cities Location:	WDH 7-135	Moos 1-450	Moos 1-450
Duluth Location:	Lib 410	LSci 165	LSci 163

Course Web Site: <https://canvas.umn.edu>

Course Director:

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Overview of the course

In *Drug Delivery I*, the students were introduced to the fundamental physicochemical principles applicable to dosage forms. These foundational principles are illuminated with key examples of solution drug dosage forms. In *Drug Delivery II*, we build on those foundational scientific principles in order to cover other dosage forms (mostly solids and dispersed dosage forms) as well as to differentiate between dosage forms. *DDII* will also cover several new areas including chemical kinetics, drug stability, buffer systems, polymers, proteins, and rheology. These topics transcend all dosage forms.

Students will apply the fundamental physicochemical principles discussed in Drug Delivery I and II in later coursework including Pharmacokinetics, Biopharmaceutics, and Pharmaceutical Compounding Lab. A thorough understanding of these fundamentals will enable students (as active learners) to adapt readily to new pharmaceutical knowledge and challenges during patient care.

Course format

The course is made up of **lectures** and **in-class learning activities**. Class meetings (lectures and in-class activities) will be on Mondays, Wednesdays, and Fridays (three class meetings a week; 50 minutes each).

Prerequisites

Successful completion of Drug Delivery I is required prior to starting Drug Delivery II.

Computer/Technology Requirements

The University of Minnesota computer requirements are listed here:

- https://docs.google.com/document/d/1artQ5e1rbzxe8IEtWo7BE8k8snZAEgMMz_QcW8yJ-II/edit

<https://www.pharmacy.umn.edu/degrees-and-programs/doctor-pharmacy/current-students/technology-resources>

Course Goals & Objectives

COURSE GOALS

The overall goals of this course include:

- Explain the scientific principles in the design, preparation and evaluation of a variety of pharmaceutical dosage forms
- Emphasize the mathematical tools needed for quantitative analysis of chemical kinetics, drug stability, and tissue drug Concentration-Time Profile.
- Engage students in active learning such that they can successfully apply the fundamentals taught in this course to case studies involving specific formulation excipients, some example drugs and disease states.

COURSE OBJECTIVES

Students who complete this course successfully will be able to:

- Calculate the shelf-life of pharmaceutical formulations.
 - Explain the role of interfacial phenomena within the context of drug dosage forms and administration.
 - Select the appropriate surfactants for preparing relevant drug formulations.
 - Describe the partitioning of molecules between immiscible fluids and apply this to the formulation of emulsions.
 - Design suspension formulations by taking into consideration the physicochemical properties (e.g., size and surface charge) of the suspended drug particles.
 - Identify the different types of colloids used in pharmaceutical dosage forms. Explain the unique properties of colloidal systems and the proper administration route.
 - Recognize the importance of viscosity in designing liquid dosage forms.
 - Explain the factors affecting the dissolution of solid pharmaceutical dosage forms.
 - Recognize the role of particle size and pore distribution on the performance/efficacy of dosage forms.
 - Identify and relate the properties of polymers to their potential use in pharmaceutical systems (e.g., as drug carriers for extended release formulations).
 - Explain how the primary, secondary, and tertiary structures of proteins may affect their physical and chemical stability.
 - Explain the relationship between formulation and absorption, distribution, metabolism, and excretion of drugs.
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Attendance Policy

Students are expected to attend every class for which they are registered. Students are expected to attend classes on the campus where they are enrolled. Instructors may choose to take attendance.

Course Materials

1. Course notes, written by each instructor, available to the students on the course website.
2. *Martin's Physical Pharmacy and Pharmaceutical Sciences*, 7th edition, Sinko, PJ, editor, Lippincott Williams & Wilkins, Philadelphia PA (2017) (ISBN 978-1-4511-9145-5)*
3. Allen LV, Popovich NG, Ansel HC, Ansel's *Pharmaceutical Dosage Forms and Drug Delivery Systems*, 11th edition, Lippincott, Williams & Wilkins, Philadelphia, PA (2018) (ISBN 978-1496347282)*

* Link to eBook is accessible through course Canvas site.

Assessments and Grading

Quizzes and Exams

Students will complete the following quizzes and exams:

- 7 online quizzes covering concepts discussed in class (lowest quiz score will be dropped)
- 30+ daily assignments (online; students can complete these after class but by the end of the day; only 30 scores will be considered; the lowest quiz scores will be dropped)
- 3 non-cumulative midcourse exams (not online; taken during class time). The first midcourse exam will cover the materials taught from the start of the semester until this exam; the second midcourse exam will cover the materials taught between the first and the second midcourse exams; the third midcourse exam will cover the materials taught between the second and the third midcourse exams. More specific details, as necessary, will be provided in the class.
- 1 comprehensive open-book final exam (not online; held during finals week).

Internet Availability for Online Quizzes

It is the responsibility of the student to ensure that reliable and appropriate Internet connection is available for the entire duration of each online quiz. The instructors/TAs are not able to solve Internet-related problems.

About the Final Exam

In the final exam, the students are provided real-life drug product and formulation-related problems. Students will be asked to integrate the concepts taught in several sections of the course, and also apply this comprehensive understanding to the problems at hand. This exam will be open book.

Assignments

A. Daily Assignments

Students will complete daily assignments, which will require knowing and applying the material taught in class on that day. While solving the daily assignments, the students will be encouraged to interact with each other and also seek the help of the TAs and instructors. Students will be required to submit their answer(s) online via a Canvas quiz, during the class session or after class but before the end of the day. Assignment keys will be posted on the Canvas site so that the students can monitor their learning. The students will be required to submit a total of 30 daily assignments. The dates proposed in the Detailed Course Outline and Schedule (below) are tentative.

B. Problem Sets

Students will complete 8 problem sets. The students will be required to submit 4 problem sets for grading. The problem sets will require students to apply concepts taught in class. Tutorial/TA sessions will be available to help the students complete the problem sets. Problem sets will be corrected and returned (typically within two weeks) to the students in order to provide timely feedback.

A detailed key for each problem set will be posted on the course Canvas site so that students can monitor their understanding of course concepts.

C. Case Study Projects:

Students will complete 4 case studies. Before each case is discussed in class, students will be required to complete a background assignment (online). The case studies are designed so that students learn to apply the basic concepts taught in the class to real-life situations. The assignments are designed to ensure that the students have reviewed the relevant background materials and are well-prepared for the in-class discussion.

Detailed Course Outline & Schedule

#	Date	Day	Title & Brief description	Lecturer	Points
1	Jan 15	W	Introduction to the course (1)	Dr. Sury	
2	Jan 17	F	Solids (1) Daily assignment	Dr. Sury	2 points
	Jan 20		NO CLASS – MLK Day		
3	Jan 22	W	Chemical Kinetics (1) Daily assignment	Dr. Sury	2 points
4	Jan 24	F	Chemical Kinetics (2) Daily assignment	Dr. Sury	2 points
	Jan 24 – 27		Online Quiz 1 – Solids & Chemical Kinetics		10 points
5	Jan 27	M	Chemical Kinetics (3) Daily assignment	Dr. Sury	2 points
6	Jan 29	W	Chemical Kinetics (4) Daily assignment	Dr. Sury	2 points
7	Jan 31	F	Semisolids (1) Daily assignment	Dr. Sury	2 points
8	Feb 3	M	Semisolids (2) Daily assignment	Dr. Sury	2 points
9	Feb 5	W	Semisolids (3) Daily assignment	Dr. Sury	2 points
	Feb 7		Graded assignment 1 – Chemical Kinetics <i>Due Fri, Feb 7</i>		25 points
10	Feb 7	F	Dissolution (1) Daily assignment	Dr. Sury	2 points
	Feb 7 – 10		Online Quiz 2 – Semisolids & Dissolution		10 points
11	Feb 10	M	Dissolution (2) Daily assignment	Dr. Sury	2 points
12	Feb 12	W	Dissolution (3) Daily assignment	Dr. Sury	2 points
	Feb 13	Th	Case Study 1 assignment <i>Due Thurs, Feb 13</i>		15 points
13	Feb 14	F	Case Study 1 discussion; exam review		
14	Feb 17	M	Midcourse Exam 1		50 points
15	Feb 19	W	Buffers (1) Daily assignment	Dr. Sury	2 points
	Feb 21		Graded assignment 2 – Dissolution		15 points

			<i>Due Fri, Feb 21</i>		
16	Feb 21	F	Interfacial Phenomena (1) Daily assignment	Dr. Sury	2 points
	Feb 21-24		Online Quiz 3 – Buffers, Interfacial Phenomena		10 points
17	Feb 24	M	Interfacial Phenomena (2) Daily assignment	Dr. Sury	2 points
18	Feb 26	W	Interfacial Phenomena (3) Daily assignment	Dr. Sury	2 points
19	Feb 28	F	Interfacial Phenomena (4) Daily assignment	Dr. Sury	2 points
20	Mar 2	M	Interfacial Phenomena (5) Daily assignment	Dr. Sury	2 points
	Mar 3		Case study 2 assignment <i>Due Tues, Mar 3</i>		15 points
	Mar 4		Graded assignment 3 – Interfacial Phenomena <i>Due Weds, Mar 4</i>		15 points
21	Mar 4	W	Case Study 2 discussion; Exam review	Dr. Sury	
22	Mar 6	F	Midcourse Exam 2		50 points
	Mar 9 – 13		SPRING BREAK – NO CLASS		
23	Mar 16	M	Disperse Systems – Emulsions & Suspensions (1) Daily assignment	Dr. Sury	2 points
24	Mar 18	W	Disperse Systems – Emulsions & Suspensions (2) Daily assignment	Dr. Sury	2 points
25	Mar 20	F	Rheology (1) Daily assignment	Dr. Sury	2 points
	Mar 20 - 23		Online Quiz 4 – Interfacial Phenomena, Disperse Systems – Emulsions & Suspensions		10 points
26	Mar 23	M	Rheology (2) Daily assignment	Dr. Sury	2 points
27	Mar 25	W	Colloids (1) Daily assignment	Dr. Johnson	2 points
28	Mar 27	F	Colloids (2) Daily assignment	Dr. Johnson	2 points
	Mar 30	M	NO CLASS – CPF Day		
29	Apr 1	W	Polymers (1) Daily assignment	Dr. Johnson	2 points
30	Apr 3	F	Polymers (2) Daily assignment	Dr. Johnson	2 points
	Apr 3 - 6		Online Quiz 5 – Rheology, Colloids, & Polymers		10 points

31	Apr 6	M	Powders (1) Daily assignment	Dr. Johnson	2 points
32	Apr 8	W	Powders (2) Daily assignment	Dr. Johnson	2 points
33	Apr 10	F	Aerosols (1) Daily assignment	Dr. Johnson	2 points
	Apr 10 – 13		Online Quiz 6 – Powders & Aerosols		10 points
	Apr 13		Graded Assignment 4 – Powders & Aerosols <i>Due Mon, Apr 13</i>		15 points
34	Apr 13	M	Proteins (1) Daily assignment	Dr. Johnson	2 points
	Apr 14		Case Study 3 assignment <i>Due Tues, Apr 14</i>		15 points
35	Apr 15	W	Case study 3 discussion & exam review	Dr. Johnson	
36	Apr 17	F	Midcourse Exam 3		50 points
37	Apr 20	M	Proteins (2) Daily assignment	Dr. Johnson	2 points
38	Apr 22	W	Incompatibilities (1) Daily assignment	Dr. Johnson	2 points
39	Apr 24	F	Incompatibilities (2) Daily assignment	Dr. Sury	2 points
40	Apr 27	M	Absorption, distribution, metabolism, excretion (ADME) (1) Daily assignment	Dr. Johnson	2 points
41	Apr 29	W	Absorption, distribution, metabolism, excretion (ADME) (2) Daily assignment	Dr. Johnson	2 points
	May 1	F	NO CLASS - Pharmacy Day		
	Apr 29 - May 4		Online Quiz 7 – Proteins, Incompatibilities & ADME		10 points
42	May 4	M	Absorption, distribution, metabolism, excretion (ADME) (3) In class assignment	Dr. Johnson	2 points
	May 5		Case study 4 assignment <i>Due Tues, May 5</i>		15 points
43	May 6	W	Case study 4 discussion	All	
43	May 8	F	Comprehensive final review	All	
	May 11-15		Final exams		98 points
			Course evaluation		2 points
			TOTAL		500 points

Statement on Penalties for Late Work

Unless approved by the course director ahead of time, late work will not be accepted.

Exam Information

Absence from Exam

There will be no make-up exams given for the midcourse and final exams except under the following circumstances:

- illness, verified by a note from a doctor
- a family emergency, verified by a note from the professional person in attendance
- a University-sponsored event, verified by a note from the leader of the sponsoring organization

The course director must approve a request for a makeup exam IN ADVANCE of the originally scheduled time of the examination.

Because students are allowed to drop a quiz score, makeup online quizzes will not be given.

Grading Information.

Point distribution:

4 Assignments (problem sets)	-	70 points
7 Online quizzes (lowest quiz score will be dropped)	-	60 points
30 Daily assignments (online; highest 30 scores)	-	60 points
3 Non-cumulative midcourse exams	-	150 points
4 Case studies	-	60 points
Final exam	-	98 points
Course Evaluation	-	2 points
Total	-	500 points

Course Letter Grades

Grade	Percentage <u>(Grades will not be rounded)</u>
A	93 - 100
A-	90 - 92
B+	87 - 89
B	83 - 86
B-	80 - 82
C+	77 - 79
C	73 - 76
C-	70 - 72
D	60 - 69
F	0 - 59

Minimum Passing Level

Per University and College Policy, students who receive a grade below D in this course must successfully repeat the course before advancing to courses that require this course as a prerequisite.

[University of Minnesota and College of Pharmacy Policy Reference \(Centralized Syllabus\)](#)

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