

Last Updated: 8.27.18

Course number and title      BMEN 452/642 Mass and Energy Transport in Biosystems

Term                                      Fall 2018

Meeting times and location    TH 12:45-2:00 in ETB 1034

## Information

Name                                      Dr. Corey Bishop

Telephone number                979.458.3126

Email address                      Dr. Bishop: cbishop@tamu.edu  
Sneha: snehashinde959@tamu.edu

Office hours                              For technical questions you will be meeting with me: Mondays and Thursdays from 3-4 pm and 2:10-3:10pm, respectively. For an appointment outside these timeframes, I request you make an appointment by e-mail.  
For non-technical questions you will be meeting with Sneha, a graduate student: a desk near the 5<sup>th</sup> floor's stair case by room 5038 (not in room 5038).  
Sneha: T/TH: 10-11:30am; F: 11-12:30.

Office location                      ETB 5016

## Course Description and Prerequisites

This course is designed to deeply understand transport phenomena within a quantitative and biological context. Quantitative analyses will be performed on single and multi-dimensional steady state and transient problems involving mass (and energy).

**Prerequisites:** BMEN 341, MATH 308

## Learning Outcomes

Upon successful completion of this course, the students will have an ability to apply mass conservation laws and differential equations in a biomedical engineering context.

## Textbook and/or Resource Material

**REQUIRED:** **Transport Phenomena in Biological Systems**, 2<sup>nd</sup> Edition, 2009. Pearson Prentice Hall Bioengineering, New York, NY. ISBN-10-0131569880 [Hardcover] **George A. Truskey, Fan Yuan and David F. Katz**

**SUPPLEMENTAL:** **Biomedical Mass Transport and Chemical Reaction: Physicochemical**

### Grading Policies

#### Grading Scale

The final grade for the course will be determined as follows:

EVALUATIONS	Course 452	Course 452 (Honors)	Course 689
Homework	22.0%	20.0%	20.0%
3 Quizzes	39.0%	35.0%	35.0%
3 Exams (Final is non-cumulative)	39.0%	35.0%	35.0%
Project (Honor's and Graduate Students)	0.0%	10.0%	10.0%
TOTAL	100.0%	100.0%	100.0%

Standard Letter Grading Scale\*:

A = 90-100%

B = 80-89%

C = 70-79%

D = 60-69%

F = <60%

\*The grading will be curved.

#### Course Topics, Calendar of Activities, Major Assignment Dates

- 1) Mass transport in biological systems (chapter 6)
- 2) Diffusion with convection or electric potentials (chapter 7)
- 3) Transport in porous media (chapter 8)
- 4) Transvascular transport (chapter 9)
- 5) Mass transport and biochemical interactions (chapter 10)
- 6) Drug transport in solid tumors (chapter 15)

**Schedule (Keywords and HW problems are subject to change); you have 1 week to bring to the class' attention conflicting exam dates with other classes. No changes to dates will be made for scheduling exams and quizzes after the first week.**

Week 1-2:

Aug. 28 – Chapter 6; HW: Problems at the back of the chapter: 6.1, 6.2, 6.3 (Replicate diffusion problem as discussed in class), 6.4, 6.6, 6.7, 6.8, 6.9, 6.10, 6.11, 6.12.

Aug. 30 – Chapter 6; see above.

Week 2:

Sept. 4 – Chapter 6; see above.

Sept. 6 – Chapter 6; see above. The HW assignment dealing with creating chapter-relevant polls is due this day.

Week 3:

Sept. 11 – Chapter 7; HW: Problems 7.16, 7.17, 7.18; Sept. 13 – Chapter 7; see above.

Week 4:

Sept. 18 – Chapter 7; see above.

Sept. 20 – Chapter 7; see above. The HW assignment dealing with creating chapter-relevant polls is due this day.

Week 5:

Sept. 25 – Quiz on Chapters 6 and 7.

Sept. 27 – Exam on Chapters 6 and 7. Problems assigned for chapters are due.

Week 6:

Oct. 2 – Chapter 8; HW: show steps for obtaining equation 8.3.37 from 8.3.36; example 8.7;

Oct. 4 – Chapter 8; see above.

Week 7:

Oct. 9 – Chapter 8; see above. The HW assignment dealing with creating chapter-relevant polls is due this day.

Oct. 11 – Chapter 9; HW: Problems 9.2, 9.4;

Week 8:

Oct. 16 – Chapter 9; see above.

Oct. 18 – Chapter 9; see above. The HW assignment dealing with creating chapter-relevant polls is due this day as well.

Week 9:

Oct. 23 – Chapter 10; HW Problems: 10.5, 10.7, 10.8, 10.16;

Oct. 25 – Chapter 10; see above.

Week 10:

Oct. 30 – Chapter 10; see above.

Nov. 1 – Chapter 10; see above.

Week 11:

Nov. 6 – Chapter 10 (PK); see above.

Nov. 8 – Chapter 10 (PCA); see above. The HW assignment dealing with creating chapter-relevant polls is due this day.

Week 12:

Nov. 13 – Quiz covering chapters 8, 9, and 10.

Nov. 15 – Exam covering chapters 8, 9, and 10. Problems assigned for chapters are due this day.

Week 13:

Nov. 20 – Chapter 15; HW Problems: 15.1, 15.2, 15.3, 15.7a, 15.8, 15.9, 15.10;

Nov. 22 – Thanksgiving Holiday

Week 14:

Nov. 27 – Chapter 15; see above.

Nov. 29 – Chapter 15; The HW assignment dealing with creating chapter-relevant polls is due this day as well. The HW assignment dealing with creating 25 transport-related web pages are due this day. If you received permission to do an additional 25 transport-related web pages for extra credit, they are also due this day. The final project for honors and graduate students is also due this day.

Week 15:

Dec. 4 – Quiz 3.

Dec. 6 – Reading Day (no class)

Week 16:

Exam 3 covering Chapter 15 (December 12 from 8-10 am; please refer to: [http://registrar.tamu.edu/Courses,-Registration,-Scheduling/Final-Examination-Schedules#5-December12\(Wednesday\)](http://registrar.tamu.edu/Courses,-Registration,-Scheduling/Final-Examination-Schedules#5-December12(Wednesday))). Problems assigned for chapter due.

### Other Pertinent Course Information

**Reading Assignments** – All pertinent chapters are required reading.

**Class Notes** – The students are responsible for all material discussed in class.

**Lectures** – Each lecture will emphasize key concepts from the pertinent chapters.

**ICPS – In class problem solving:** In class, we will deeply discuss and solve problems in the back of each pertinent chapter.

**Posted Lecture Slides** – All information posted (even if not covered in class) are potential quiz or exam material.

**Homework** – Homework problems at the back of each chapter will be due on the day of the exams. The homework involving the polls will be due on the last day we cover the chapter. The semester-long HW (webpages) are due Nov. 29.

Further HW info:

Poll HW (due the last day we cover that specific respective chapter):

Poll HW for each chapter: <https://www.pharmacoengineering.com/hw-due-the-day-we-finish-chapter/> Please note that you can do more than 3 polls, if you wish to do so and this could be of benefit because if I like the polls I may use them for the quizzes.

Semester-long HW (due: Nov. 29):

Week 1-15: HW: See week 15 for further information (must fill out the entire form with zero “no”s): <https://www.pharmacoengineering.com/hwassignment/>

**Quizzes** - Quizzes will cover the previous chapters and are designed differently than exams by the length of time per problem. For example, the quizzes will be conceptually-based (most of the time) and generally not require much time per problem if the concepts are well understood.

**Exams** – Exams will cover all information up to that particular exam. Anything posted on the internet on [pharmacoengineering.com](http://pharmacoengineering.com) related to class material and anything I cover in lecture is potentially testable.

**Final Exam** – Non-cumulative (I reserve the ability to make it cumulative).

**Extra Credit** – All students can repeat the web page-based HW assignment 1 extra time for extra credit.

**Research Project: Option 1 (for honors and graduate students):** Each honors and graduate student will prepare and submit a research paper. The research paper is to be based upon a personally conducted literature review and on a mathematical model or simulation conducted in MatLab, COMSOL Multiphysics (or Excel), or some combination of the foregoing. All topics must be pre-approved by Dr. Bishop. The research paper must emphasize a **critical review** of a biotransport engineering topic. The emphasis of the critical review must be on a critical assessment of the approaches and findings of the contributions of the reviewed topic. It is not enough to outline the author's or your approach or to summarize the author's or your findings. Rather, your research paper **must display critical insight** into the approaches used, opportunities missed and findings gleaned from the reviewed work. These critical reviews may be guided by questions such as: *How would you have approached this body of work? What are the limitations of theory that may be applied to the work? What did you learn with the new suggested modifications?*

Projects of this type will be graded at the end of the semester only and is due the last day of class before the 3<sup>rd</sup> exam.

**Research Project: Option 2 (for honors and graduate students):**

Another option for the project would be to complete the web page HW assignment 3 more times. The advantage to choosing the web page option is that you could submit throughout the semester and you could ensure that you receive full credit for the project.

### **Americans with Disabilities Act (ADA)**

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit <http://disability.tamu.edu>.

### **Academic Integrity**

For additional information please visit: <http://aggiehonor.tamu.edu> "An Aggie does not lie, cheat, or steal, or tolerate those who do."