

## **BME150 BIOTRANSPORT PHENOMENA**

(Required for BME and BMEP)

- Catalog Data:** **BME150 Biotransport Phenomena (Credit Units: 4)** Fundamentals of heat and mass transfer; similarities in the respective rate equations. Applications to biological mass transport at cellular and systems level. Methods and instruments used to study mass transfer processes, including microcirculation. Emphasis on practical application of fundamental principles. Prerequisites: BME110A-B. SAME as CBEMS 125C. (Design units: 1)
- Textbook:** No textbook required. Access to MATLAB is required. Version R20007a is recommended.
- References:** *Transport Phenomena In Biological Systems*, Truskey, G.A. Yuan, F., and Katz, D.F., Pearson Prentice Hall Bioengineering, 2004.  
*Fundamentals of Heat and Mass Transfer*, Incropera and DeWitt, John Wiley & Sons, 2002. (old editions acceptable)  
*Basic Transport Phenomena in Biomedical Engineering*, Fournier R.L., Taylor & Francis, 2006.
- Coordinator:** Bernard Choi
- Relationship to Program Outcomes:** This course relates to the Program Outcomes for:  
**BME:** a. c. e. g. h. I, j, and k as stated at:  
<http://undergraduate.eng.uci.edu/degreeprograms/biomedical/mission>
- Course Outcomes / Performance Criteria:** Students will:  
Demonstrate knowledge of the conservation of heat and mass plus the associated constitutive laws. (BME a)  
Demonstrate knowledge of constitutive data unique to living systems including their magnitude and scale. (BME a)  
Describe which laws and data are relevant to a specific biological system and process. (BME a)  
Demonstrate how to apply these laws of the solution of biological problems. (BME a, c, h)  
Develop/refine effective general engineering problem definition and solving skills leading to adaptive expertise. (BME a, c, g, i, j, k)  
Develop skills to disseminate information in both written and oral communications. (BME g)
- Prerequisites By Topic:** Sophomore-level calculus and biology, basic programming skills. (preferably in MATLAB)
- Lecture Topics:** Heat transfer processes (diffusion and convection).  
One-dimensional, steady state diffusion.  
Two-dimensional, steady-state diffusion.  
Transient diffusion.  
External flow.  
Internal flow.  
Diffusion mass transfer.

Physical properties of the body fluids and the cell membrane.  
Diffusion with convection.  
Conservation relations.  
Physical and flow properties of blood  
Fluid flow in circulation and tissues  
Oxygen transport  
Transport in the kidneys  
Drug transport/pharmacokinetics

**Class Schedule:** Meets for 3 hours of lecture and 1 hour of discussion each week for 10 weeks.

**Computer Usage:**

**Laboratory Projects:**

**Professional Component:** Contributes toward the Biomedical Engineering Topics.

**Design Content Description**

*Approach:* Computational model development to simulate heat and mass transfer principles (100%).

*Lectures:* 100%

*Laboratory Portion:* 0%

**Grading Criteria:**

Homework:	40%
Midterm:	20%
Final exam:	<u>30%</u>
	100%

**Estimated ABET Category Content:**

Mathematics and Basic Science: 0 credit units or 0%

Engineering Science: 3 credit units or 75%

Engineering Design: 1 credit units or 25%

**Prepared by:** Bernard Choi

**Date:** July 2008

**CEP Approved:** Fall 2007