**BME150 BIOLOGICAL MASS TRANSFER**

(Required for BME and BMEP)

**Catalog Data:** **BME150 Biological Mass Transfer (Credit Units: 4)**
Mass transfer in gas, liquid and solid with application to biological systems. Free and facilitated diffusion, active transport, convective mass transfer, diffusion-reaction phenomena, biological mass transfer coefficients, steady and unsteady transport, and flux-force relationships. Applications to bioengineering design. Prerequisites: BME110A-B. (Design units: 1)

**Textbook:** Truskey, G. A., Yuan, F., and Katz, D. F., *Transport Phenomena in Biological Systems,* Pearson Prentice Hall Bioengineering, 2004.

**References:**

**Coordinator:** Bernard Choi

**Course Outcomes:** Students will:
Define cell, organ and organ system transport and biomedical engineering principles.
Develop a quantitative understanding of transport phenomena in biological systems.
Apply simple engineering principles to analyze and predict cellular ands super-cellular processes.
Describe and analyze elements of engineering “design” utilized in biological systems.
Develop rational hypotheses to improve on biological designs.

**Prerequisites by Topic:** Sophomore-level calculus and biology

**Lecture Topics:** Definition and relative importance of transport and reaction processes: diffusion, convection, and binding.
Transport within cells, transcellular transport and physiological transport systems.
Application of transport processes in disease pathology, treatment and device development.
Conservation relations and boundary conditions: mass, momentum.
Fluid statics and dynamics: constitutive relations.
Laminar and turbulent flow.
Application to rheology and flow of blood.
Dimensional analysis.
Low Reynolds number flow.
Mass transport: solute fluxes, conservation relations, and constitutive relations.
Estimation of diffusion coefficients: steady and unsteady diffusion, Stokes-Einstein equation.
Diffusion with convection or electrical potentials.
Mass transport and biochemical interactions.
Chemical kinetics: reversible and irreversible reactions.
Enzyme kinetics: Michaelis-Menten

**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 and Major Design experience.

**Relationship to Program Outcomes:** This course relates to Program Outcomes (a), (b), (c), (d), (e), (g), (h), (i), (j), and (k) as stated at: http://undergraduate.eng.uci.edu/degreeprograms/biomedical/mission

**Design Content Description:**

***Approach:*** Specific discussions on mass and momentum equations and their applications (50%). Students will use learned math and biotransport skills to design systems and devices for biotechnology (50%).

***Lectures:*** 100%

***Laboratory Portion:*** 0%

**Grading Criteria:**

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|---|---|
| Homework: | 30% |
| Midterm: | 30% |
| Final: | 40% |
| | 100% |

**Estimated ABET Category Content:**

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|---|---|---|---|---|
| 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 2007

**CEP Approved:** Fall 2002