BME150 BIOLOGICAL MASS TRANSFER

Catalog Data: **BME150 Biological Mass Transfer (Credit Units: 4) S.** 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: TBA.

Coordinator: Vittorio Cristini.

Course Outcomes: Students will be able to:
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: Each class meets 3 hours per week for 10 weeks and students are assigned to a 1 hour discussion session per week.

Computer Usage: No formal computer usage.

Laboratory Projects: None.

Professional Component: Contributes toward the Biomedical Engineering Topics and Major Design experience.

Relationship to Program Outcomes: This course relates to Program Outcomes 1, 3, 9, and 10 as stated at: http://www.eng.uci.edu/dept/objective_biomedical.

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:

Grading Criteria:

Homework:	30%
Midterm exam:	30%
Final exam:	40%
	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: Vittorio Cristini **Date:** July 2005

CEP Approved: Fall 2002