



ILLINOIS

Department of Bioengineering, Fall 2009

BIOE 504: Analytical Methods for Bioengineering

Instructor: Michael F. Insana, mfi@illinois.edu 244-0739
4247 Beckman (Office hours M-W 11:00 am – 12 noon)
<http://ultrasonics.bioen.uiuc.edu>

Time and place: MW 9:00 am – 10:50 am, Room 2320 DCL
Prerequisites: MATH 385 (Differential Equations); programming course
Required Books: Course notes
Recommended Books: *Mathematical Techniques for Biology and Medicine*,
W. Simon, Dover, NY, 1986.
Introduction to Mathematical Biology, SI Rubinow, Wiley & Sons, 1975.
Digital Image Processing Using Matlab, RC Gonzalez,
RE Woods, SL Eddins, Pearson Prentice Hall, NJ, 2004

This is a required course for all bioengineering graduate students. The objective is to introduce/review mathematical methods related to data management, modeling, and computation that are common in bioengineering research. Assignments involve combinations of mathematical and numerical modeling in Matlab. Course grade is based on performance on homework (30%), weekly quizzes (40%), and final exam (30%).

- Introduction: mathematical and computational notation, operators, special functions
- Correlation, convolution, Fourier analysis in continuous and discrete variables
- Probability review: continuous and discrete random variables (RVs)
- Random processes: expectation, Bayesian analysis, functions of RVs
- Linear systems and Laplace analysis
- Statistical design: hypothesis testing, error analysis, ML estimation
- Task-based performance assessments, ROC analysis, SNR
- Review of ordinary differential equations (ODEs)
- ODE modeling of biological compartments, radioactive decay, blood flow
- Instrumentation design using linear systems, ODE, Laplace analyses
- Systems of equations: predator-prey problem

Resources:

- Engineering Workstations are available throughout the College of Engineering buildings. For locations and hours see: <http://ews.uiuc.edu/labs/>
- The EWS User Guide including tutorials can be found at <http://ews.uiuc.edu/userguide/>
- A nice listing of application software available in Window can be found at <http://ews.uiuc.edu/ews-s/software/software.cgi?category=winapps>

Semester Schedule:

Classes begin	Monday August 24
Labor Day Holiday	Monday Sept 7
Thanksgiving Holiday	Monday Nov 23-27
Last Day of Classes	Wednesday Dec 9 (Final Exam)