THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Numerical Simulations in BME

BIOMEDE 2700

Credit Hours:
2.00

Course Levels:
Undergraduate (1000-5000 level)

Course Components:
Lecture
Lab

Course Description:
Focuses on the application of computer-based numerical and graphical display skills for solving problems relevant to biomedical engineering.

Prerequisites and Co-requisites:
Prereq: 2000, and enrollment in BiomedE major, or permission of instructor
Concur: Math 2174

Course Goals / Objectives:
- Students will be confident with the implementation of de-novo code and numerical methods to solve BME problems.
- Students will identify their own preconceived limitations on coding and learn how to tackle them.
- Students will understand the utility of coding as a necessary and important skill for problem solving.
- Students will recognize that real-world BME problems are open-ended and complex.
- Students will be able to develop and execute MATLAB programs to graph and visualize biologically relevant data (ABET 2).
- Students will be able to develop and execute MATLAB programs to find numerical solutions for sets of linear and non-linear algebraic equations describing biological phenomena.
- Students will be able to develop and execute MATLAB programs to find numerical solutions for differential equations describing biological phenomena (ABET 1, B)
- Students will be able to perform parameter estimation using MATLAB to approximate equations describing biological phenomena (ABET 1, B)

Course Topics:

- Fundamentals: Modeling and Simulation, Extensive Properties, Intensive Properties: Accounting and Conservation, Equations, Review of MATLAB Environment (calculator, scripts/functions, graphics), Vectors (vector manipulation, force representation, bio
- Graphics and Visualization: Point Plots of Experimental Data, Line Plots of ECG Data, Curve Fits of Stress Relaxation Data, Image Processing (digital image fundamentals, histograms)
- Algebraic Balance Equations: Systems of Linear and Non-linear Equations (direct methods, iterative methods)
- Differential Balance Equations: Differential Equations (Hodgkin Huxley equation, cell differentiation, constitutive equations of viscoelastic tissues)
- Numerical Data Analysis: Numerical Integration & Differentiation, Interpolation & Extrapolation, Least Squares Regression, Parameter Estimation (pharmacokinetic model fitting)

Designation:

Required