



**THE OHIO STATE UNIVERSITY**  
COLLEGE OF ENGINEERING

# Quantitative Physiology

## BIOMEDE 3703

**Credit Hours:**

3.00 - 3.00

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**Course Levels:**

Undergraduate (1000-5000 level)

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**Course Components:**

Recitation  
Lecture

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**Course Description:**

Introduces students to the mathematical and numerical techniques used to develop, solve and analyze quantitative models of physiological systems.

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**Prerequisites and Co-requisites:**

Prereq: 2700, Anatomy 2220, and Math 2174; or permission of instructor.

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**Course Goals / Objectives:**

- Plot solutions to physiological models and conduct sensitivity analysis to determine the relative importance of different physiological parameters on system behavior
  - Conduct least squared regression analysis to extract model parameter values from experimental data
  - Construct, solve and analyze compartmental models of the circulatory system using systems of linear equations
  - Use ordinary differential equations to construct models of various physiological systems (endocrine, neuronal, etc) and will be able to write MatLab routines to solve and analyze these ODE models
  - Solve partial differential equations using the COMSOL package, model various physiological systems (cardiovascular, cellular), and conduct simulations and analyze models using the COMSOL software package
  - Evaluate the accuracy of various physiological models by comparing numerical solutions with analytical solutions and describe the pros and cons of different models
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**Course Topics:**

- Introduction & Numerical Errors
  - Systems of Equations & Circulation
  - ODE models of stem cells, hormone transport, renal clearance and muscle
  - ODE models of neuronal and cardiac action potentials
  - ODE and PDE models of diffusion/drug delivery and tissue oxygenation
  - PDEs of cardiovascular systems (arterial pulse and by-pass surgery)
  - PDEs of calcium signaling and mechanotransduction
  - Advanced Models
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**Designation:**

Required