MATH 613: Advanced Applied Mathematics I: Modeling
Fall 2018 Graduate Course Syllabus

Grading Policy: The final grade in this course will be determined as follows:

Assignments	28%
Midterm Exam	32%
Final Exam	40%

Grading Policy: The final grade in this course will be determined as follows:

A	85-100
B+	76-84
B	67-75
C+	58-66
C	50-57
F	0-49

Homework Policy: Homework is assigned each week, and is expected to be handed in on time. Late submissions will be penalized.

Exams: There will be one midterm exam held in class during the semester and one comprehensive final exam. Exams are held on the following days:

Midterm Exam	October 25, 2018
Final Exam Period	December 15 - 21, 2018

Course Outline

Date	Topic
Sep 4	Basics of modeling (introduction). Units, dimensions, dimensional analysis, and scaling.
Sep 6	Nondimensionalization and the Buckingham's Π theorem
Sep 11	Nondimensionalization: examples from various models.
Sep 13	ODE models: 1D models and the phase line; 2D models and the phase plane
Sep 18	ODE models: chemical reactions and the principle of mass action
Sep 20	ODE models: SRI model for infectious disease propagation in a population
Sep 25	ODE models: perturbation methods, asymptotic series
Sep 27, Oct 2	Introduction to continuum models: review of the Divergence Theorem, continuity equation, vector calculus, Einstein notation for vector derivatives
Oct 4, 9	Random walks and the diffusion equation.
Oct 11, 16	Wave phenomena 1: Traffic modeling, method of characteristics, and shocks.
Oct 18, 23	Wave phenomena 2: Maxwell's Equations, electrostatics, EM wave in vacuum
Oct 25	Midterm Exam
Oct 30	Wave phenomena 2 continued: more on EM and Maxwell's Equations
Nov 1, 6, 8	Stochastic processes: method of characteristics to solve for the generating function
Nov 13, 15	Continuum processes: Inviscid and viscous fluid flows
Nov 20, 27, 29	Models in neuroscience: Goldman-Hodgkin-Katz equation, Hodgkin-Huxley and Morris-Lecar models of excitable cell
Dec 4	Reaction-diffusion equations 1: Fisher's Equation
Dec 6, 11	Reaction-diffusion equations 2: Cell calcium dynamics; asymptotic methods for PDEs