Mathematics Department
Brooklyn College, City University of New York
Math 3202 (Mathematical Modeling and Simulation)
4 hours, 4 credits

Suggested Textbooks:
- A First Course in Mathematical Modeling, 5th ed, by Giordano, Fox and Worton, Brooks/Cole Publication, 2014
- Mathematical Modeling: A Case Studies Approach, by Illner, Bohun, McCollum, Roode, STML 27, American Mathematical Society, 2005
- Simulation, 5th Edition, by Sheldon Ross, Academic Press, 2012.

1. Discrete-time deterministic models
   - Modeling change with one-dimensional difference equations
   - Approximating change with one-dimensional difference equations
   - Exact solutions to linear difference equations; existence and stability of equilibria
   - Systems of difference equations; existence and stability of equilibria
   - Numerical simulation of difference equations: regular vs chaotic behavior

2. Discrete-time probabilistic models
   - Random numbers generation
   - Monte Carlo simulation and deterministic problems
   - Monte Carlo simulation and probabilistic problems
   - Inventory models
   - Queuing models
   - Markov chains with a finite state space; connection with difference equations models

3. Continuous-time deterministic models
   - Modeling change with a differential equation
   - Graphical solutions of autonomous first-order differential equations; qualitative theory
   - Numerical simulation of one-dimensional differential equations: Euler's method
   - Graphical solutions of systems of autonomous first-order differential equations
   - Euler's method for systems of differential equations
   - Chaotic behavior: the Lorenz attractor

4. Continuous-time probabilistic models
   - Methods to generate normal random variables
   - Methods to generate Poisson and exponential random variables
   - Poisson process
   - Brownian motion
   - Stochastic differential equations and the Euler-Maruyama method