Syllabus for MATH-UA.0251-001 'Introduction to Mathematical Modeling' , Spring 2019

Instructor: Alex Mogilner mogilner@cims.nyu.edu, mogilner2@gmail.com

Lectures: Mondays, Wednesdays
9:30-10:45AM
CIWW 1302

Office Hrs: Tue 11-2, Thu 3-4

Recitations: Fridays
9:30-10:45AM CIWW 101
11:00-12:15PM CIWW 202

TA: Chen Li chenli@cs.nyu.edu

Lecture 1, Jan 28	Organization of the class; Program of Applied Math; SIR model	Ppt Lec1SIR	Read 'WhatIsAppliedMath'
Lecture 2, Jan 30	Scaling, part 1	Ppt Lec2-4Scaling	Read 'Scaling'
Lecture 3, Feb 4	Scaling, part 2	Ppt Lec2-4Scaling	Read 'Scaling'
Lecture 4, Feb 6	Scaling, part 3	Ppt Lec2-4Scaling	Read 'Scaling'
Lecture 5, Feb 11	Directional flow, steady states for one nonlinear ODE	Ppt SlidesForLec5QualAnalysisODE	Read chapter 6 of Tung's book; and Genetic switch example is in the text 'KeshetBook1'
Lecture 6, Feb 13	Euler's method; solving ODEs using Matlab scripts	Ppt SlidesForLec6LecNumericsODE	
Lecture 7, Feb 20	Numerical solutions of ODEs using Matlab ode45 routine	Ppt Lec7numericalODE	Read files in folder 'Matlab'
Lecture 8, Feb 25	Difference equations; dynamics in discrete time	Ppt Lec8DiscreteTime	Read chapter 7 of Tung's book
Lecture 9, Feb 27	Difference equations; dynamics in discrete time		
MT exam 1, March 4	Matrices in age-structured models, Leslie matrices		
Lecture 10, March 6	Linear algebra models, vision of the horse-shoe crab		
Lecture 11, March 11	ODE systems, steady states, phase plane analysis		

Lecture 12, March 13	ODE systems, stable nodes, flagellar length model		
Lecture 13, March 25	Special guest lecture: Cellular Potts Model		
Lecture 14 March 27	Special guest lecture: Molecular motors		
Lecture 15, April 1	ODE systems, excitable behavior: SIR and Fitzhugh-Nagumo models		
Lecture 16, April 3	ODE systems, limit cycle oscillations: cell cycle model		
MT exam 2, April 8			
Lecture 17, April 10	ODE systems, Romeo-Juliet model; Lotka-Volterra; competition for resources		Read chapter 9 of Tung's book
Lecture 18, April 15	Scaling laws; vascular systems and protein		Read chapter 2 of Tung's book
Lecture 19, April 17	Modeling relationsip		Read chapter 10 of Tung's book
Lecture 20, April 22	More than 2 ODEs: Chaos and model of climate		Read chapters 11-12 of Tung's book
Lecture 21, April 24	Stochastic models: Poisson and other stochastic processes		
Lecture 22, April 29	Master equation		
Lecture 23, May 1	Langevin equation		
Lecture 24, May 6	Monte Carlo and Gillespie methods		
MT exam 3, May 8			

Book: K.K. Tung 'Topics in Mathematical Modeling'

How your work will be evaluated:

A few HWs will be assigned to test your math methods skills. Deadlines will be announced;
Absolutely no late HWs will be accepted. Total HW grade will account for 30% of the grade.

Three exams: March 4, April 8, May 8. Modeling problems will be posed for the exams.
Two best exams will count for 35% each.

Individual exams will not be curved. The curve will be applied only at the very end, after all exams are taken, and grades averaged. Therefore please do not ask in the middle of the course what grade you are likely to get. I expect the majority getting A and B.

There will be absolutely no makeup exams under any circumstances. If you miss 1 exam, no worries, the other two will be used for the final grade. If you miss 2 exams, then one will count as zero, and in principle you can still get C-. Missing all exams, regardless of the reason, you fail the course. Cheating or plagiarizing will be treated as per NYU Policies. No books or any kind of electronic devices will be allowed at the exams.