Modeling the Systems World 10.007

2017 Term 3 Course Syllabus

Format:

- 1 lecture on Monday, 1 hour
- 2 cohort sessions, 2 hours each

Grades:

• Exam 1	25%
• Exam 2	25%
• Quiz 1	10%
• Quiz 2	10%
• Homework	15%
• Project	10%
• Participation	5%

Homework:

- Assigned (almost) every Monday.
- Typically, due on Monday the following week at 5:30PM, unless otherwise specified due to public holidays or other conflicts. We will provide clear indication of the due date on each homework set.
- Late homework is accepted up to 1 day with 2 points penalty.
- Solutions will be posted at 5:30pm on Tuesdays, after which no late homework will be accepted.
- Pigeon holes for homework collection are located on Building 1 Level 7.
- There will be 10 HW sets (5-10 questions each).
- One randomly chosen question will be fully graded for 3 points; the rest will receive 1 point for each genuine attempt (with work shown), 0 otherwise.

You are encouraged to work together on homework questions, but you **must write your own solutions**. We will not accept identical/similar solution sets. If necessary, **disciplinary action** will be taken. Note that students who share their homework or project solutions will be punished equally severe as those who copy.

Quizzes:

- Quiz 1: **February 9/10** (week 3), beginning of class
- Quiz 2: **March 30/31** (week 10), beginning of class

Exams:

- Exam 1: **Wednesday March 1** (week 6), 2:30-4:30pm
- Exam 2: **Thursday April 27** (week 14), 9:00-11:00am

2D Projects:

- Interdisciplinary project.

Participation:

- Participation will include cohort attendance and involvement in activities.

Topics:

Week	Topics
1	Systems Modeling, Optimization Paradigm, Applications
2	Global Optimality and Convexity, First and Second Order Optimality conditions, Convex Function and Optimization
3	Unconstrained optimization, Local descent
4	Constrained Optimization with Equality Constraints: Lagrange Multipliers and their interpretation
5	Linear functions, Linear Programming and Integer Programming (Graphically), Excel Solver
6	Networks: Terminology, Modeling, Flow Problems
8	Differential Equations, System Modeling Applications, Types of First Order ODEs, Applications
9	Higher Order Linear ODE, Homogeneous Linear Equations, Solution Methods, Applications
10	Higher Order Linear ODE, Nonhomogeneous Linear Equations, Laplace Transform
11	2D Project
12	Laplace Transform, Properties, Step and Delta Functions, Transformation of IVP, Applications
13	First Order System of ODEs, Matrices and Linear Systems, Linear Homogeneous Systems, Eigenvalue Methods, Applications

Texts:

- Optimization
  - The calculus book used in the previous terms (G. Simmons, Calculus with Analytic Geometry) will be a good resource.
  - Some parts of the course are not covered by the textbook. Students are expected to use the material and resources provided or recommended by the course instructors.
  - S. Bradley, A. Hax and T. Magnanti, Applied Mathematical Programming, 1977. Soft-copy available at http://web.mit.edu/15.053/www/. Only two chapters from this book will be used in the course.
- Ordinary Differential Equations
  - C. H. Edwards and D. E. Penney, Elementary Differential Equations with Boundary Value Problems, 6th edition, 2007.