Course Syllabus

for

CHE657 Process Analysis and Modeling II

2nd Semester, 2018

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Course Description:

This course is officially known as Process Dynamics and Modeling II, which is a continuation of CHE656 Process Dynamics and Modeling I, and deals primarily with fundamentals of chemical process optimization, an important aspect of process simulation and modelling.

This course once again consists of 2 parts: lectures and design projects. In design projects, students will work in teams and make regular presentations with the same format as that in CHE656. The design problems will involve studying various metaheuristics for optimization and coding them in MATLAB to solve a variety of optimization problems including those encountered in chemical engineering. Basics of optimization will be first introduced, which include optimization of single variable, multiple variables, unconstrained optimization, constrained optimization, linear programming, nonlinear programming, dynamic programming, etc. Real applications involving chemical systems will be used as illustrations of the different optimization techniques. This course is essential to understanding CHE659 (Optimization of Chemical Processes) in which process optimization using A+ will be emphasized.

You will be graded based on the following areas:

Homework (5 sets)	10%
Midterm (3 hours)	30%
Final Exam (3 hours)	30%
Design Project (team)	30%
- Presentations (10%)	
- Final Report (20%)	

Note that homework assignments and solutions are to be downloaded from my web site at www.cheps-kmutt.com. Their due dates will be posted there as well.

Textbooks and References:

1. *Optimization of Chemical Processes*, 2nd Edition, by T.F. Edgar. and D.M. Himmelblau, and L.S. Laasdon, McGraw-Hill, 2001.

2. *Applied Mathematical Programming*, by S.P. Bradley, A.C. Hax, and T.L. Magnanti, Addison Wesley, 1977.

3. *LINDO User's Manual*, by LINDO Systems Inc., 1999.

4. Supplementary Lecture Notes at www.cheps-kmutt.com.

5. *CHE 657 Exercise Problems* by Dr. Hong-ming Ku, 2016.

The following is an outline of topics to be covered in this course:

1. Basic Concepts of Optimization

2. Optimization of Unconstrained Single Variable
   - Indirect methods vs. direct methods
     a) Region-elimination methods
     b) Newton-Raphson and Quasi-Newton methods
     c) Secant method
   - Using *fminbnd* in MATLAB

3. Unconstrained Multivariable Optimization
   - Indirect methods vs. direct methods
     a) Steepest descent
     b) Sequential simplex
     c) Conjugate search and conjugate gradient method
   - Using *fminunc* and *fminsearch* in MATLAB

4. Linear Programming
   - Simplex algorithm
   - Using LINDO

5. Nonlinear Programming with Constraints
   - Using *fmincon* in MATLAB

6. Discrete and Staged Optimization
   - Integer programming
   - Using LINDO

7. Design Projects