

CBE 660 — Intermediate Problems in Chemical and Biological Engineering — Fall 2013

Homework 1 **Due: Wednesday, September 11**

Exercise 1.1, 1.6
Exercises 2.1, 2.5, 2.8 (class handout)
Linearly independent chemical reactions, conservation of chemical elements, inner product.

Homework 2 **Due: Wednesday, September 18**

Exercise 1.13
Exercises 2.9, 2.13 (class handout), 2.16
See the “Latest Exercises” link on www.che.wisc.edu/~jbrow/chemreacfun for Exercise 2.16.
Fundamental theorem of linear algebra and stoichiometry, maximal set of linearly independent reactions.

Homework 3 **Due: Wednesday, September 25**

Exercises 1.17, 1.18, 1.19, 1.20
Partitioned matrix inversion formula, inner product and orthogonality of vectors, existence and uniqueness of solutions to linear equations.

Homework 4 **Due: Wednesday, October 2**

Exercises 1.21, 1.22, 1.45
Fitting functions and least squares, estimating activation energy from kinetic data, linear difference equation and singular value decomposition.

EXAM 1. Wednesday, October 8, 6:30-8:00

Matrix exponential and coupled linear differential equations, singular value decomposition, differentiating scalars, vectors, and matrices.

Homework 5 **Due: Wednesday, October 16**

Exercise 2.11, 2.26
Differentiating integrals, flow in porous medium.

Homework 6 **Due: Wednesday, October 23**

Exercises 2.12, 3.16, 3.17
Convolution theorem, temperature profile in tube flow, gamma function, error function.

Homework 7 **Due: Wednesday, November 30**

Exercises 2.13, 3.18, 3.19, 3.23

Final and initial value theorems, some useful integrals, small Laplace transform table, time dependent heating of a semi-infinite slab.

Homework 8

Due: Friday, November 6

Exercises 2.38, 2.39, 2.40, 3.3

Existence and uniqueness of solutions to linear differential equations. Divergence of flux in polar coordinates

EXAM 2. Tuesday, November 19, 6:30-8:00 p.m.

Homework 9

Due: Friday, November 15

Exercises 3.27, 4.1, 4.22

Numerical evaluation of heat conduction in slab, cylinder and sphere. Univariate normal, multivariate normal and linear transformation.

Homework 10

Due: Wednesday, December 4

Exercises 4.26, 4.31

Least squares parameter estimation, least squares and confidence intervals.

Homework 11

Due: Wednesday, December 11

Exercises 5.6, 5.7, 5.20

Diffusion equation in 1-d, random walk in 1-d, nonlinear stochastic kinetics.

FINAL EXAM. Wednesday, December 18, 10:05-12:05 a.m.