**Unit 1 Skill Sheet – ChE 421**

All of these topics are fair game for the first exam (Oct. 2 during class). Please study class notes, PSETs, and book examples closely. The exam will not throw new material at you, just what we have covered through our reading, in class work, or home work.

* Process control diagrams
* Labeling control elements (transmitter, controller, etc.)
* Identifying CV, DV, MV, and control objective
* Feed-back vs. feed-forward
* Degree of freedom analysis
* What is a controller?
* General form of conservation balance (rate of accumulation)
* Setting up dynamic models (ODEs) for
  + Mass balance
  + Mass component balance
  + Energy balance
* Laplace transforms
* Solving ODEs with Laplace transforms (by hand, with Table 3.1)
* Partial fraction expansion, a.k.a. Heaviside expansion
* Initial value and final value theorems for Laplace space expressions
* Modeling time delays
* Perturbation or deviation variables
* Different types of forcing functions and how to write them in Laplace domain
* Definition of transfer function
* Linearization of 1 and 2 variable expressions
* Transfer functions in parallel
* Transfer functions in series
* First order transfer function - general form w/ definition of K (gain) and τ (time constant)
* Solutions of first order transfer function under various forcing functions
* Second order transfer function – general form, new variable ζ (zeta) = damping term
* Oscillatory behavior identified by ζ value
* Finding second order model terms from oscillatory response
* Poles and pole-plots
* Numerator dynamics – zeros
* Identifying overshoot and inverse response
* FOPTD and SOPTD models
* Converting higher order models to FOPTD and SOPTD models with
  + Taylor series
  + Pade approximation
  + Skogestad’s half rule
* Fitting experimental data to determine transfer functions (Chp. 7 – PSET 5)

The exam is open book and open note. Computers can ONLY be used to access electronic notes. If Matlab is found open or internet use is observed, you will receive an automatic zero. If you are using your computer, you will sit in a designated area to be watched over by Dr. Reuel or Dillon.