

## ChE-400 ABET Goals

First developed: Fall 2002

Last modified: Fall 2003 (09/07/03)

<b>1a Apply Knowledge to chemical engineering from subjects:</b>
<b><i>1a1 Mathematics</i></b>
1a1 Perform algebraic computations
1a1 Calculate roots of equations using bracketing (bisection and false point) and open methods (Newton-Raphson and secant)
1a1 Perform basic matrix operations (add, multiply)
1a1 Identify different types of matrices (identity, diagonal, banded, inverse, transpose)
1a1 Calculate the determinant of a matrix using cofactors
1a1 Calculate the adjoint matrix
1a1 Calculate the inverse matrix using the adjoint matrix
1a1 Solve systems of linear algebraic equations (Cramer's rule, gauss Jordan, Gaussian elimination, Gauss Jordan, inverse matrix)
1a1 Express linear algebraic equations in matrix form
1a1 Linearize non-linear algebraic equations
1a1 Perform numerical differentiation using backward, forward and central approximations
1a1 Perform numerical integration using Newton-cotes methods (trapezoidal rule and Simpson's 1/3 rule)
1a1 Classify differential equations according to linearity, order, boundary conditions, and number of variables involved
1a1 Solve homogenous, constant coefficients, ordinary differential equations (characteristic polynomial method)
1a1 Calculate Laplace transform of a function
1a1 Calculate inverse Laplace transform of a function
1a1 Decompose a polynomial ratio using partial fractions
1a1 Solve ordinary linear differential equations using Laplace Transform
1a1 Solve systems of ordinary linear differential equations using Laplace Transform
1a1 Solve ordinary differential equations (linear/nonlinear) using Euler's method
1a1 Solve ordinary differential equations (linear/nonlinear) using Runge-Kutta method (second order)
1a1 Solve systems of ordinary differential equations (linear/nonlinear) using Euler's method
1a1 Solve systems of ordinary differential equations (linear/nonlinear) using Runge-Kutta method (second order)

1a1 Define the objective function for an optimization
1a1 Define the design variables for an optimization
1a1 Define the constraints for an optimization
1a1 Explain the mathematical meaning of an optimization (minimum, maximum)
<b>1a2 Chemistry</b>
1a2 Use of reaction rate expressions
1a2 Define variables that affect reaction rates
1a2 Correct use of stoichiometry
1a2 Use ideal gas law and other P,T correlations
<b>1b Apply knowledge of chemical engineering fundamentals</b>
1b1 Perform material balance with constant volume
1b1 Perform material balance with variable density
<b>1e Solve engineering problems</b>
1e1 Draw schematic diagram of process/problem (label streams and variables)
1e1 Express objective as math expression
1e1 Identify dependent/independent variables, and parameters
1e2 Analyze available data
1e2 Search for necessary information (research production information, pollution levels, product handling, product transportation, physical property information)
1e4 Select appropriate theory and fundamentals (material balance, chemistry)
1e4 Develop governing equation
1e4 Write boundary and initial conditions
1e5 Define model assumptions
1e5 Apply model assumptions
1e6 Identify the math problem and solution procedure
1e6 Write a programming logic diagram
1e6 Develop solution algorithm/code
1e7 Follow modeling procedure (definition of problem, objective function, apply theory and assumptions, identify math problem, develop solution algorithm, analyze solution)
1e8 Check input/output values for reasonableness
1e8 Determine convergence criteria
1e8 Check units
1e8 Analyze answer and order of magnitude of solution
1e8 Propose alternate solutions
<b>2a Participate effectively in a team</b>
2a1 Demonstrate leadership in a team
2a2 Contribute to the success of the team
<b>2b Communicate</b>
2b2 Use correct writing mechanisms (organization of calculation, details and comments)
2b2 Clear expression of thoughts
2b2 Correct spelling and grammar
2b3 Clear meaningful graphs and tables

<b><i>1f1 Use current engineering tools</i></b>
1f1 Use of excel to produce graphs
1f1 Use Matlab to write solution algorithms (linear algebraic equations, nonlinear algebraic equations, optimization, roots of equations, ordinary differential equations, Laplace transform, systems of ordinary differential equations)
1f1 Define appropriate guesses
1f1 Enhance program readability (adequate comments, explanation of inputs, correct units)
1f1 Develop correct code (does the program runs without errors or warnings)

Last Changed (Fall 2003, 09/07/03): Improper integrals have been eliminated from the program due to time constraints