TABLE PT4.2 Specific study objectives for Part Four.

1. Understand why and where optimization occurs in engineering problem solving.
2. Understand the major elements of the general optimization problem: objective function, decision variables, and constraints.
3. Be able to distinguish between linear and nonlinear optimization, and between constrained and unconstrained problems.
4. Be able to define the golden ratio and understand how it makes one-dimensional optimization efficient.
5. Locate the optimum of a single variable function with the golden-section search, quadratic interpolation, and Newton's method. Also, recognize the trade-offs among these approaches, with particular attention to initial guesses and convergence.
6. Be capable of writing a program and solving for the optimum of a multivariable function using random searching.
7. Understand the ideas behind pattern searches, conjugate directions, and Powell's method.
8. Be able to define and evaluate the gradient and Hessian of a multivariable function both analytically and numerically.
9. Compute by hand the optimum of a two-variable function using the method of steepest ascent/descent.
10. Understand the basic ideas behind the conjugate gradient, Newton's, Marquardt's, and quasi-Newton methods. In particular, understand the trade-offs among the approaches and recognize how each improves on the steepest ascent/descent.
11. Be capable of recognizing and setting up a linear programming problem to represent applicable engineering problems.
12. Be able to solve a two-dimensional linear programming problem with both the graphical and simplex methods.
13. Understand the four possible outcomes of a linear programming problem.
14. Be able to set up and solve nonlinear constrained optimization problems using a software package.