

EML 4534 - COMPUTER APPLICATIONS IN MECHANICAL ENGINEERING 2  
Common Course Syllabus

Catalog Data: 3 credits. Review of MATLAB language, numerical methods utilized in solving mechanical engineering problems, projects related to solid body mechanics, and thermal systems.

Prerequisites:

1. Computer Applications in Engineering I – EGN 2213 or COP 2220C
  2. Engineering Mathematics I – MAP 3305  
or Differential Equations I – MAP 2302
  3. Statics - EGN 3311
- (all with a minimum grade of C)

Topics:

1. Introduction – Why numerical methods?
2. Review of MATLAB concepts
  - a. Fundamentals
  - b. System of linear equations
3. Optimization
  - a. Unconstrained optimization  
Method of deepest descent, MATLAB *fminunc* function
  - b. Constrained optimization  
Lagrange multipliers, linear programming, gridding/graphics, MATLAB *linprog* function
  - c. MATLAB *fmincon* optimization function
4. Numerical integration
  - a. Simpson's rule
  - b. Improper integrals
  - c. MATLAB *integral*, *integral2* functions
5. Solution of differential equation
  - a. Euler and Runge – Kutta methods for a system of ordinary differential equations
  - b. MATLAB *ode45* function
6. Simulation of dynamic systems
  - a. Laplace transform and transfer function
  - b. Simulation using Simulink
  - c. Connect MATLAB script and Simulink
7. Advanced curve fitting
  - a. Method of least squares
  - b. Cubic spline fitting
  - c. MATLAB *interp*, *lscurvefit*, *cftool* functions

Course Outcomes: (numbers in parentheses indicate correlation of the outcome with the appropriate ABET program outcomes 1-7)

1. Students should be capable of programming engineering-type problems (e.g., statics and dynamics) in MATLAB. (1)
2. Students should be able to utilize built-in ODE solvers in MATLAB. (1)
3. Students should be capable of solving dynamic systems in Simulink. (1)
4. Students should be able to use different optimization techniques. (1)

5. Students should be able to present results from MATLAB programming in a neat manner and using plots and tables (3)

Updated 10/24