1. EM425 Numerical Methods for Engineers

2. Credit Hours (3) / Contact Hours (3)

3. Course Director – CAPT Stu Blair

4. Course Textbook: Numerical Methods for Engineers and Scientists, 3rd Ed., by A. Gilat, and V. Subramaniam, Wiley, 2014 ISBN 978-1-118-55493-7

5. Specific course information
   a. An introduction to numerical techniques for solving mathematical problems relevant to a range of engineering and physical systems. Applications are drawn primarily from mechanical, nuclear, and aerospace engineering. Lectures and programming assignments will cover a range of topics to include solutions of systems of linear equations, solution of non-linear equations, curve fitting, numeric integration, and numeric solution methods for differential equations. Students will undertake a project using numerical methods and present their results.
   b. Prereq: SM212 and (EM215, EA208, EN275, EN330, EW202, EE322, or SI204)
   c. Senior engineering elective course

6. Educational objectives
   1) Understand the fundamentals of numerical methods with emphasis on the most essential algorithms and methods.
   2) Enhance their scientific computing skills using the MATLAB environment to implement algorithms and learn to critically evaluate their results.
   3) Understand the fundamentals of the Finite Element Method and have attained proficiency using the COMSOL software tool to carry out a multi-physics analysis of relevant physical models.
   4) The ability to formulate a problem of interest and apply numerical methods and computational tools to solve the problem and communicate pertinent results to others.

7. Specific program outcomes addressed by this course

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Reinforced | | | | | | | |
| Mastered | X | | | | | X | |

8. Brief list of topics to be covered
   a. Linear Algebra
   b. Solving Non-linear Equations
   c. Gauss-Elimination and LU-Decomposition
   d. Curve Fitting
   e. Numeric Differentiation
      i. Finite Difference
      ii. Lagrange Polynomials

f. Numeric Integration
    i. Newton Cotes Formulas
    ii. Gauss Quadrature
    iii. Monte Carlo Methods
g. Solving Initial Value Problems
h. Solving Boundary Value Problems (Linear and Non-Linear)
i. Finite Element Methods