ABET course syllabus (Engineering Numerical Methods)

1. *Course number and name*
   0941301: Engineering Numerical Methods

2. *Credits and contact hours*
   3 Credit Hours

3. *Instructor's or course coordinator's name*
   Instructor: Shadi Moqbel, Assistant Professor of Civil Engineering
   Course Coordinator: Shadi Moqbel, Assistant Professor of Civil Engineering

4. *Text book, title, author, and year*
   - "Numerical Methods for Engineers", Steven Chapra and Raymond Canale, 6th Edition

   a. *other supplemental materials*
      - " Applied Numerical Analysis ", C. F. Gerald, and P. O. Wheatley, Addison-Wesley Publishing Company.
      - "Numerical Analysis", R. L. Burden and J. D. Faires, PWS-Kent.
      - "Numerical Analysis", L.W. Johnson and R. Riess, Addison-Wesley.

5. Specific course information
   a. *brief description of the content of the course (catalog description)*
      Algorithms to solve linear and non-linear equations. Solution of simultaneous linear equations using various methods: Gaussian elimination, Gauss-Jordan and Iterative Gauss-Siedel method. Optimization: unconstrained and constrained optimization. Curve fitting: Least square regression, Newton divided difference interpolation, Lagrange interpolation, Spline interpolation and Fourier Approximation. Numerical differentiation and integration. Numerical solution of ordinary differential equations: Runge-Kutta methods and Boundary-value problems. Introduction to partial differential equation methods: Finite element method and finite difference method.

   b. *prerequisites or co-requisites*
      Prerequisite: Engineering Math 1 (0301202)

   c. *This course is a required course in the Civil Engineering program*

6. Specific goals for the course
   a. *specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.*
      - The Student will solve engineering problems using numerical methods
      - The Student will be able to apply curve fitting methods
      - The Student will evaluate the percent approximate error associated with the iterative numerical methods

   b. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.*
      Course addresses ABET Student Outcome(s): a

7. *Brief list of topics to be covered*
   - Introduction
     - Solution methods
   - Roots of Equations
     - Bracketing methods: Bisection method and False-position method.
     - Open methods: Simple Fixed-point iteration method, Newton-Raphson method, Secant method, Modified Secant method, Multiple roots.
   - Roots of System of Equations
     - Non-Linear Equation: solving using Fixed-point iteration method and Newton-Raphson Method
     - Linear Equations: solving using Naive Gaussian elimination, Gauss-Jordan and Iterative Gauss-Siedel method
   - Optimization
     - Unconstrained optimization
     - Constrained optimization
   - Curve fitting
     - Least square regression
     - Newton divided difference interpolation
     - Lagrange interpolation
     - Spline interpolation
     - Fourier Approximation
   - Numerical Integration and Differentiation
     - Newton-Cotes Integration Formulas
     - Integration of equations
     - Numerical Differentiation
   - Ordinary differential equations
     - Runge-Kutta methods
     - Boundary-value problems
   - Introduction to partial differential equations
     - Finite difference method
     - Finite element method