THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Numerical Analysis Methods for Civil and Environmental Engineering Applications

CIVILEN 2060

Credit Hours:
4.00 - 4.00

Course Levels:
Undergraduate (1000-5000 level)

Course Components:
Lecture
Lab

Course Description:
Implement numerical solution techniques using computer programming in MATLAB and apply them to a variety of problems related to Civil Engineering.

Prerequisites and Co-requisites:
Prereq: 2050 or Stat 3450, 3460, or 3470; and Math 2173, 2177, 2255, or 2415; and enrollment in CivilEn or EnvEng major.

Course Goals / Objectives:
- Provide civil and environmental engineering students the tools and background to apply numerical methods for solving engineering problems

Course Topics:

- MATLAB environment & programming; Program execution and flow. Loops and conditions; Representation of numbers in a computer, arrays and indexing, numerical error
- Solving nonlinear equations; Defining functions, function interface; Estimation of error, convergence; Newton-Raphson method for one equation and for a system of non-linear equations
- Linear algebra and Solving systems of Linear Equations; Matrix definition, matrix dimension, matrix multiplication; Representation of a system of equations using a matrix-vector system; Gauss elimination method, LU decomposition method.
- Interpolation and curve fitting; Curve fitting with a linear equation, curve fitting with quadratic and higher-order polynomials; Interpolation and extrapolation; Piecewise interpolation, splines.
- Numerical differentiation; Finite difference approximation, differentiation formulas.
- Numerical integration; Midpoint rule, trapezoidal rule, Euler’s method, Simpson’s rules.
- ODE Implicit vs. explicit methods; Initial value problems: Euler methods (explicit, implicit), modified Euler method, midpoint method, Runge-Kutta methods; Boundary value problems - finite difference method; Time integration - Crank Nicolson method

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Designation:
Required