Department of Civil & Environmental Engineering - KFUPM

CE 318 Numerical & Statistical Methods in Civil Engineering

First Semester 151

List of Computer-Lab Sessions

Week SN	Lab Subject	Objectives & Coverage (Including: Examples, Applications and Lab Assignments)
1	Overview of and Utilizations of Particular Programming Features of *Excel*	To introduce commonly used *built-in* functions in *Excel*, conditional calculations, cells and ranges naming, *Lookup* function (Utilization for analysis of selected case-studies)
2	Basic Programming Tools of *Mathematica* Software	To introduce basic *computational* and *graphical* functions in *Mathematica* (Function definitions; Plotting functions; Symbolic calculations; Analysis of selected case-studies)
3	Interpolation (*Excel* & *Mathematica*)	Curve fitting and forward and reverse Interpolation using 1st and 2nd order interpolating polynomial (*Excel* & *Mathematica*)
4	Least Squares Regression (*Excel*)	Curves fitting using Least Squares Method in *Excel*
5	Root Finding using *Excel*	Root Finding (*Excel*) by bi-section method, false-position method, fixed-point method, and *Excel* Solver

6	Root Finding using *Mathematica*	1- To introduce the following *Mathematica* built-in functions for root finding:
		    a) Solve
		    b) NSolve
		    c) FindRoot
		 2- Show the limitations of each of the above functions
		 3- Use them to solve root-finding problems

7	Symbolic Integration (*Mathematica*) & Numerical Integration (*Excel* & *Mathematica*)	Symbolic & Numerical Integration using *Mathematica built-in* functions, and Numerical Integration using trapezoidal and Simpson's 1/3 and 3/8 rules in *Excel*
8	Linear & Nonlinear Algebraic Equations using *Excel*	Solution of systems of Linear & Nonlinear Algebraic Equations using Excel tools: Matrix manipulation functions and Solver.

9	Solving Linear & Nonlinear Algebraic Equations using *Mathematica*	1- To show how to do matrix manipulation using *Mathematica*
		 2- To demonstrate the usage of key *Mathematica built-in* functions for solving linear and nonlinear equations including:
		    a) LinearSolve
		    b) Inverse
		    c) Solve
		    d) NSolve
		    e) F indRoot

10	Exact solution of ODEs (*Mathematica*) & Numerical solution of ODEs (*Excel* & *Mathematica*)	Exact solution of ODEs in *Mathematica* Numerical solution of ODEs in *Mathematica* using method of Finite Differences
11	Descriptive statistics (*Excel*)	Descriptive Statistics, Normal distribution & Probability in *Excel* & *Mathematica*
12	Solving Constrained Optimization problems	Linear & Nonlinear Constrained Optimization using *Mathematica* and *Excel*