UNIVERSITY OF MANITOBA | **Department of Electrical and Computer Engineering**

24.781 Computational Electromagnetics

ASSIGNMENT 3
The Finite-Element Method

December 8, 2005 **Due Date: Friday, December 23, 2005**

A) Summarize the variational formulation of the Finite Element Method as applied to Poisson's equation in two and three dimensions for closed regions. Give the formulas for first- and second-order basis functions on triangles and tetrahedrons. Describe fully the elements of the matrices which have to be solved.

B) Write a general purpose program (or modify an existing one) to implement the FEM for Poisson's equation in two and three dimensions for closed regions using first-order elements. Fully describe the program using excerpts from the code. Run your program on an example of your choice and comment on the accuracy by validating the results. (You can use the analytic solution from Assignment 1 if you wish.) You may want to use the Gmsh mesh generator which can be found at http://www.geuz.org/gmsh/