<u>Computer Assignment 1</u>: ME-503(2D steady state diffusion problem)
Total marks: 10
Submission date: On or before 15th October, 2012.

Q. Solve 2D steady state heat conduction problem in a thin rectangular plate (width of the plate w = 100 cm, height h = 100cm and thickness t = 1cm) governed by Dirichlet boundary conditions. The two faces of the plate are insulated and hence there is no heat conduction along the z- direction (thickness of the plate). The thermal conductivity of the plate material is 100 W/m ^{o}C. The top edge of the plate is maintained at temperature $T = 100\sin(\pi x/w)$ ^{o}C and other edges are maintained at T = 0 ^{o}C as shown in the Fig.

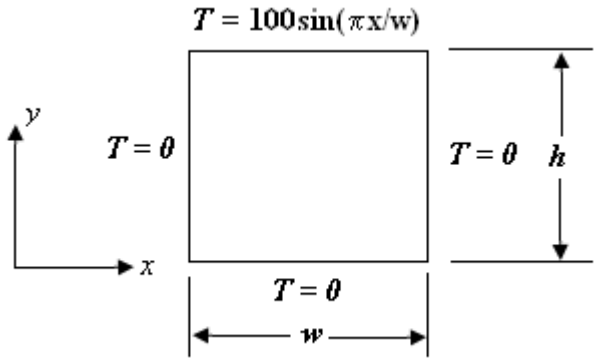

Figure: Computational domain and boundary conditions

The analytical solution of the temperature inside the plate is given by $T(x,y) = 100\frac{\sinh\left(\frac{\pi y}{w}\right)\sin\left(\frac{\pi x}{w}\right)}{\sinh\left(\frac{\pi h}{w}\right)}$ where w and h are width and height of the plate respectively.

Make a computer code to solve the problem using finite volume method and compare the results with analytical solution. Solve the problem at least considering 20×20 numbers of control volumes for the whole plate. For solving the system of linear algebraic equations you can use any iterative method such as Gauss- Seidel or point successive over-relaxation (PSOR) method. Show the results of temperature plots for both the analytical and numerical results.