Consider a steady state heat transfer in an L-shaped solid body whose cross-section is given in the figure below. The thermal conductivity of the body is = $15\,W/m.K$. The right surface of the body is 5 cm and insulated, and the bottom surface is 10 cm and maintained at a uniform temperature of 100 °C. The top surface is 5 cm on both sides of the step and the entire top surface is subjected to convection to ambient air at $T_\infty = 25$□ with a convection coefficient of $h_{conv} = 80\,W/m^2.K$. The left surface is 2 cm and has a constant heat flux of 2 W/m^2. Use finite difference formulation to determine the temperature distribution in the body. Use $\Delta x = \Delta y = 1cm$ as the mesh interval. Solve the problem using Matlab/Octave. Show the temperature distribution as isotherms on a Matlab plot. Also calculate and show the heat flux at each node on a Matlab plot. Hand in your report on a CD containing all the relevant files and plots.

The steady state heat transfer equation can be treated as

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$

Deliverables

Your report should include the description of the problem, how you set up the problem, assumptions, method of solution, the Matlab code that you used, the results, all relevant plots, discussion and potential weaknesses in your solution method. Hand in your work on a CD.