

MECE 5397

## Project B – Diffusion Equation

Write a computer code to solve the two-dimensional diffusion equation

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{\partial u}{\partial t} \quad (1)$$

The domain of interest is the rectangle

$$a_x < x < b_x, \quad a_y < y < b_y \quad (2)$$

and the boundary conditions

$$u(x, y = b_y) = f_a(x), \quad u(x, y = a_y) = g_a(x), \quad (3)$$

$$\left. \frac{\partial u}{\partial x} \right|_{x=a_x} = 0, \quad u(x = b_x, y) = g_a(b_x) + \frac{y - a_y}{b_y - a_y} [f_a(b_x) - g_a(b_x)] \quad (4)$$

$$a_x = a_y = 0, \quad b_x = b_y = 2\pi \quad (5)$$

$$g_a(x) = (x - a_x)^2 \cos x, \quad f_a(x) = x(x - a_x)^2 \quad (6)$$

The initial condition is

$$u(x, y, t = 0) = 0. \quad (7)$$

Use ghost node(s) for Neumann condition(s).

Carry out the time integration to steady state, i.e., until the result becomes independent of time.