Home Work Problem 5

An infinite parallel-sided slab of length \((0 \leq x \leq L)\) of thermal diffusivity \(\alpha\) is initially \((t = 0)\) at uniform temperature \(T_0\). Its two ends are subsequently maintained at a constant temperature \(T_1\). Use the explicit method to determine the temperature variation with time and position. First, rewrite the unsteady, one-dimensional governing equation in the non-dimensional form using the following non-dimensionalization scheme.

\[
\theta = \frac{T - T_0}{T_1 - T_0}, \quad \tau = \frac{\alpha t}{L^2}, \quad \xi = \frac{x}{L}
\]

Plot the temperature \((\theta)\) distributions at \(\tau = 0.35, 0.25, 0.1\) and 0.05.

Discuss the choice of time steps with regard to stability and accuracy.

Include a copy of your computer program and representative printed results.

Page limit: 5