ENGINEERING PHYSICS 4D3

Assignment #2

Set:
Due:

1. Consider a planar source of neutrons in an infinite medium consisting of mixture of cadmium, water and aluminum. Use the following properties for the mixture:

   $S = 100$ n/cm^2 sec, $\Sigma_a = 12.56$ cm^{-1}, $D = 0.5252$ cm, $L = 0.2045$ cm.

   a. Solve for and plot the steady state flux profile as a function of distance from the source using analytical methods.

   b. If you were to solve this problem numerically, as you will in Question 2, you'd need to approximate infinity somehow. Determine, from your answer to part (a), the distance (in terms of the diffusion length L, ie 1 L, 2L, 10L, 100L) at which the flux is effectively zero.

2. Using the boundary conditions determined in Question 1, calculate the steady state flux profile numerically. Compare the steady state flux profiles for Questions l and 2. Comment.

3. Calculate the flux profile as a function of space and time using the following numerical methods. Use the boundary conditions from Question 1b and the initial condition that the flux at t=0 is zero.

   a. Explicit method. Use the largest Δt possible for a stable solution. Try a Δt one order of magnitude smaller than the largest possible value.

   b. Semi-implicit method. Use the two Δts from part a. Use a very large Δt (2 orders of magnitude larger than the largest possible Δt in part a).

   c. Plot the flux as a function of time at the source location for the explicit and implicit methods.

   d. For either method, plot the entire flux profile as a function of time. Use the following format for the graph: