Assignment 4

Advanced Mathematical Techniques in Chemical Engineering (CH 61015)

Full Marks: 40

Completely solve the following PDEs:

1. $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$

Subject to

At t=0, u=u_0; at x=0, $\frac{\partial u}{\partial x} + 2u = 0$; at x=1, u=0

2. $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$

Subject to

At t=0, u=u_0; at x=0, $\frac{\partial u}{\partial x} + 4u = 0$; at x=1, $\frac{\partial u}{\partial x} = 0$

3. The one dimensional, transient heat transfer problem is given as:

$$\rho c_p \frac{\partial T}{\partial t} = k \frac{\partial^2 T}{\partial x^2}$$

At t=0, T=T_0; at x=0, $k\frac{\partial T}{\partial x} + h\left(T - T_\infty\right) = 0$; x=L, $\frac{\partial T}{\partial x} = 0$

4. The one dimensional, transient heat transfer problem is given as:

$$\rho c_p \frac{\partial T}{\partial t} = k \frac{\partial^2 T}{\partial x^2}$$

At t=0, T=T_0; at x=0, $-k\frac{\partial T}{\partial x} = q_0$; x=L, $k\frac{\partial T}{\partial x} + h\left(T - T_\infty\right) = 0$