

ASG-7

1. Consider following eqn

$$\frac{\partial^2 u}{\partial x^2} - \frac{1}{a^2} \frac{\partial u}{\partial t} = 0.$$

This is diffusion eqn, that describes disorganisation of a system. The variable satisfies following Dirichlet boundary cond.

$$u(x, t) \Big|_{t=0} = 1 \quad x > 0$$

$$= 0 \quad x < 0$$

• Notice that the eqn and the boundary cond are invariant under: $(x, t) \rightarrow (sx, s^2 t)$.

a) Find the soln for $t > 0$.

b) Can we find a reasonable soln for $t < 0$?

Explain physically.

2. Show that Helmholtz eqn $\nabla^2 \psi + k^2 \psi = 0$ is still separable in circular cylindrical coordinates if k^2 is generalised to $k'^2 + f(\rho) + \frac{1}{\rho^2} g(\phi) + h(z)$, $k' \equiv \text{const.}$

3. Consider particle in a box of sides a, b, c . The wave fun describing the particle vanishes at each surface of the box. Find the smallest value of energy for which we can find a non-trivial wave fun.