**Chapter 14: Partial Differential Equations**

- one dimensional

, , - spatial

- time

A partial differential equation is a differential equation involving partial derivatives of one or more dependent variables with respect to more than one independent variables.

Example:

- linear

- non-linear

- non-linear

First Order, First Degree, Linear Partial Differential Equations can be solved using Lagrange’s Method and First Order, First Degree, Non-Linear Partial Differential Equations can be solved using Charpit’s Method. These two methods will not be discussed here.

## Higher Order Linear Partial Differential Equations

Separation of Variables

Assume

Example

Use the method of separation of variables to solve the heat equation over , for the boundary conditions and initial condition .

is a function of and . Assuming ,

Taking ,

Here, increases exponentially with if and decreases exponentially with if . In any physical problem, only the latter case is meaningful. To emphasize this, let .

Auxiliary Equation:

At ,