

NAME : Ikram Ullah

ID : 7976

SECTION: B

DEPARTMENT: BE Civil

SUBMITTED TO: Mam Shumaila.

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Assignment # 04



## => " Applications of Partial Differential equation " :-

=> In this, we will discuss briefly some of the most important PDEs that arise in various branches of science and engineering.

We shall see that some equations can be used to describe a variety of different situations.

### 1.) Wave Equation :-

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

$$a.) \frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2} - g$$

$$b.) \frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2} - a \frac{\partial u}{\partial t}$$

$$\frac{\partial^2 u}{\partial t^2} = c^2 \left( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right)$$

$$\frac{\partial^2 u}{\partial t^2} = c^2 \left( \frac{\partial^2 u}{\partial r^2} + \frac{1}{r} \frac{\partial u}{\partial r} + \frac{1}{r^2} \frac{\partial^2 u}{\partial \theta^2} \right)$$



## 2.) Heat Conduction Equation:

$$\frac{\partial u}{\partial t} = K \frac{\partial^2 u}{\partial x^2} \quad \therefore 0 \leq x \leq L$$

$$t > 0$$

$$\frac{\partial u}{\partial t} = K \left( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right)$$

## 3.) Transmission Line Equation:-

$$\frac{\partial^2 i}{\partial x^2} = LC \frac{\partial^2 i}{\partial t^2} + (RC + GL) \frac{\partial i}{\partial t} + RG i$$

$$\frac{\partial^2 i}{\partial x^2} = RC \frac{\partial i}{\partial t}$$

## 4.) Laplace's Equation:-

$$\frac{\partial u}{\partial t} = K \left( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right)$$

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$$



5.) Poisson's Equation:-

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f(x, y)$$

6.) Helmholtz's Equation:-

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + k^2 u = 0$$

7.) Schrödinger's Equation:-

$$-\frac{h^2}{8\pi^2 m} \left( \frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} + \frac{\partial^2 \psi}{\partial z^2} \right) = E \psi$$

8.) Transverse Vibrations Equation:-

$$a^2 \frac{\partial^4 u}{\partial x^4} + \frac{\partial^2 u}{\partial t^2} = 0$$