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Section

# B

Dept

# Civil

Assignment No

# 04

Submitted to

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(1)

## ⇒ Application 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.

(i) Heat conduction equation:

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

$t > 0$

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

(2) Laplace's equation:

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

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

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

(2)

(3) Poisson's Equation

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

(4) Transverse vibrations equation

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

(5) Helmholtz's Equation

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

(6) Schrodinger's Equation

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

(3)

(7) Transmission Line Equation.

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

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

(8) wave equation

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

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

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

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

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