Indian Institute of Technology Patna
MA201- (Partial Differential Equation) July-November 2019

Tutorial - 4 **Instructor: Dr. Pratibhamoy Das**

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1. A string is fixed at $x = 0$ and $x = L$ and lies initially along the x-axis. If it is in motion by giving all points of $0 < x < L$ by a constant transverse velocity $\frac{\partial u}{\partial t} = u_0$ at $t = 0$, then find the subsequent motion of the string.

2. Using Duhamel's principle, solve

$$u_{tt} - u_{xx} = x - t, \quad \infty < x < \infty,$$
$$u(x, 0) = 0, \quad u_t(x, 0) = 0.$$

3. Prove that the solution of the Dirichlet problem continuously depends on the given boundary data. (Hint: You may use the Maximum and Minimum principle)

4. (Application of PDE) A stretched string of length L is held fixed at both ends and is subjected to an initial displacement $u(x, 0) = u_0 \sin(\pi x/L)$, where u_0 is a given constant. Now, the string is released from this position with zero initial velocity. Find the resultant time dependent motion of the string.

5. Given the Fourier series $x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty} \frac{(-1)^n}{n^2} \cos(nx)$, $-\pi < x < \pi$, deduce that $\sum_{n=1}^{\infty} \frac{1}{n^4} = \frac{\pi^4}{90}$ by using Parseval's identity.