ASSIGNMENT 3

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Subject Code : **MC-406** Course Title : **Partial Differential Equations**

Course Coordinator : Dr. Aditya Kaushik
Office : FW4-TF1 (Top Floor, Mechanical Engineering Department)
Contact : Mob. No. : +91-8427580104 Email Id. : apkaushik@gmail.com

Syllabus

Unit -3 The wave equation: Fourier series solution of wave equation, Numerical solution of wave equation, The infinite and semi infinite string problems, the d'Alembert solution.

Instructions

Write your name and roll number on the first page of your assignment. The assignment should be legibly handwritten and on both sides of the paper. I will follow a zero toleration policy towards copying in any form. The assignment must be submitted as a single pdf file before the due date without fail. For any further query feel free to contact me. Timely submission of the assignment will be appreciated. There will be no credit for late submissions.

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1. Obtain a Fourier series solution for the wave equation $u_{tt} - c^2 u_{xx} = 0$ such that
$$\begin{cases} u(0,t) = 0, \quad u(L,t) = 0 \\ u(x,0) = f(x) \ \text{ and } \ u_t(x,0) = g(x). \end{cases}$$

2. Derive the formula for the D'Alembert solution of the wave equation on a half-line.

3. Solve the following using Duhamel's principle
$$\begin{cases} u_{tt} - c^2 u_{xx} = h(x,t); \ \ x \in \mathbb{R}, \ \ t > 0 \\ u(x,0) = 0 \ \text{ and } \ u_t(x,0) = 0. \end{cases}$$

4. A tightly stretched violin string of length l fixed at both ends is plucked at $x = l/3$ and assumes the shape of a triangle of height a initially. Find the displacement of the string if it is released from rest.

5. Solve

$$\begin{cases} u_{tt} - 9u_{xx} = 2\sinh x; \quad x \in \mathbb{R}, \quad t > 0 \\ u(x,0) = x \ \text{ and } \ u_t(x,0) = \sin x. \end{cases}$$

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