**Final Term Examination**

Spring Semester 2020

**Subject:** Diffierential Equations.  **Time Duration**: 6 Hours

**Total Marks:** 50

**Note:** Attempt all questions.

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| **Q.No.1** |  ***(20)*** |

THE WAVE EQUATION:
We generally visit beach and if we stand on an ocean shore and take a snapshots of the waves, the picture shows a regular pattern of peaks and valleys in an instant of time. We see periodic vertical motion in space, with respect to distance. If we stand in the water, we can feel the rise and fall of the water as the waves go by. We see periodic vertical motion in time. This beauty symmetry is expressed by the one-dimensional wave equation.

$$\frac{∂^{2}w}{∂t^{2}}=c^{2}\frac{∂^{2}w}{∂x^{2}}$$

Where w is the wave height, x is the distance variable, t is the time variable and c is the velocity with which the waves are propagated.

**Show the following functions are all solutions of the wave equation by determining relevant partial derivatives.**

1. $w = sin(x + ct) + cos(2x +2ct)$
2. $w=\tan((2x+ct))$

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| **Q.No.2**  |  ***(10)***  |

Expand the following function in a Fourier series

F(x) = x, -$π <x \leq 0$

 = 2x, 0 $\leq x \leq π$

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| **Q.No.3** |  ***(10)***  |

 Solve the initial value problem

 $y^{''}-4y^{'}+13y=8sin3x, y\left(0\right)=1 and y^{'}\left(0\right)=2$

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| **Q.No.4** |  ***(10)***  |

 Solve

 ($D^{2}- DD’) z$ = $Cos x Cos 2y$