Jaypee Institute of Information and Technology
Department of Mathematics

Course: Matrix Computations (16B1NMA533)

Tutorial Sheet 13 [C301-3.6]

(Topics covered: Solution of Differential Equations using Matrix Calculus, Discrete Dynamical Systems)

1. **Solve the following system by using the matrix method**

$$\dot{x}(t) = -2x + 3y(t) + 1$$

$$\dot{y}(t) = -x(t) + 2y(t) + 1$$

2. **Solve the following differential equation by using the matrix method**

$$\ddot{x}(t) = -4x(t) + sin\ t, \qquad x(0) = 1, \dot{x}(0) = 0$$

3. **Convert the following second order system of difference equations into fundamental form:**

   (i) $v(t+2) - 6v(t+1) + 4w(t+1) - 3v(t) + w(t) = 0$

   (ii) $w(t+2) + w(t+1) + 3v(t+1) - 2w(t) = t\,3^t$

4. **Solve the following difference equations:**

   (i) $y(t+2) + 3y(t+1) + 2y(t) = 0,\ y(0) = -1,\ y(1) = 7$

   (ii) $u(t+1) = \begin{bmatrix} 6 & -2 \\ -2 & 9 \end{bmatrix} u(t), u(0) = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

   (iii) $u(t+1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} u(t) + \begin{bmatrix} t^2 \\ 0 \\ t \end{bmatrix}, u(0) = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$