

**ASSIGNMENT 2-APPLICATION OF DIFFERENTIAL AND DIFFERENCE  
EQUATIONS (MAT2002)**

**1:** Solve the following differential equations by using the method of undetermined coefficients

(1)  $\frac{d^2y}{dx^2} - \frac{dy}{dx} + y = 2 \sin 3x$

(2)  $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 4y = 2x^2 + 3e^{-x}$

(3)  $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = x^2e^{-x}, \quad .$

**2:** Solve the following differential equations by using the method of variation of parameters

(1)  $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} = e^x \sin x$

(2)  $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x e^x \sin 2x, \quad y(0) = 0, \quad y'(0) = 0$

**3:** Solve the following differential equations

(1)  $x \frac{d^2y}{dx^2} + \frac{dy}{dx} - \frac{y}{x} = -ax^2$

(2)  $4x^2 \frac{d^2y}{dx^2} + y = \log x$

(3)  $(2x + 3)^2 y'' - 2(2x + 3)y' - 12y = 6x$

**4:** Find the eigenvalues of following system and hence find general solution by matrix method

(1)  $x'(t) = -3x + 6y + 5z, \quad y'(t) = 2x - 12y, \quad z'(t) = x + 6y - 5z, \quad x(0) = x_0, \quad y(0) = 0, \quad z(0) = 0.$

(2)  $x'_1 = -3x_1 + x_2 - 6e^{-2t}, \quad x'_2 = x_1 - 3x_2 + 2e^{-2t}.$

**5:** Find the general solution to given system of equation by method of diagonalization

$$x''_1 = 6x_1 + x_2, \quad x''_2 = 4x_1 + 3x_2.$$

**6:** If the governing equation of mass-spring system is given by  $my'' + cy' + ky = r(t)$ , where mass  $m = 2$  units, damping constant  $c = 0$  and spring constant  $k = 10$  and  $r(t) = 3u(t-12) - 5\delta(t-4)$ , then find the displacement  $y$ , using Laplace transform method, with initial conditions  $y(0) = -1, y'(0) = -2$ .