1. Solve $y' = 3x - \dfrac{y}{x}$; $\quad y(1) = 5$. (10%)

2. Solve $y'' - 4y' + 4y = 4e^{2x}$; $\quad y(0) = 2$, $\quad y'(0) = 1$. (15%)

3. Solve $x^2 y'' - 5xy' + 10y = 0$; $\quad y(1) = 4$, $\quad y'(1) = -6$. (10%)

4. Solve $y'' + y = t$, $\quad y(0) = 1$, $\quad y'(0) = 0$ by Laplace transform. (20%)

5. Solve $y'' + 2y' + 2y = \delta(t-3)$, $\quad y(0) = y'(0) = 0$ by Laplace transform. (10%)

6. Solve

$$|\mathbf{A}| = \begin{vmatrix} 3 & -1 & 1 & -2 \\ -1 & 3 & 2 & 5 \\ 3 & -1 & 5 & 1 \\ 2 & 2 & 1 & -3 \end{vmatrix}. \quad (10\%).$$

7. Find the eigenvalues and the corresponding eigenvectors of the matrix

$$\mathbf{A} = \begin{bmatrix} 3 & 3 \\ 1 & 5 \end{bmatrix}. \quad (10\%)$$

8. Find the Fourier series of the function

$$f(x) = \begin{cases} 0, & -3 \le x \le 0 \\ x, & 0 \le x \le 3 \end{cases}. \quad (15\%)$$