1. Evaluate $I = \oint_C \cot(z)dz$, where C is the unit circle $|z| = 1$ traversed in a clockwise sense. (15%)

2. Let $f(x) = x^2/2$ for $-0 \le x \le \pi$. Find the Fourier series of f(x) and evaluate the sum of the series $\sum_{n=1}^{\infty} \frac{1}{n^2}$. (15%)

3. Find the general solution of the equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dt} + 2y = \delta(x-3)$.
(20%)

4. Solve $\dot{X} = AX$, where $X^T = [x_1 \quad x_2]$, $\dot{X} = dx/dt$,

$A = \begin{bmatrix} 1 & 3 \\ -3 & 7 \end{bmatrix}$, the superscript "T" denotes transpose of a vector or matrix.
(15%)

5. Let $F(x,y,z) = (-y+z, x+yz, xyz)$. By applying Stokes' Theorem, compute the integral of Curl F over the hemisphere $x^2+y^2+z^2=1, z \ge 0$, with outwards normals.
(15%)

6. Find the general solution of $y'' - \frac{4}{x}y' + \frac{4}{x^2}y = x^2+1$, $x > 0$, where $y' \equiv dy/dx$, $y'' \equiv d^2y/dx^2$.
(20%)