

國立聯合大學 112 學年度碩士班考試招生

電機工程學系 入學考試試題

科目： 工程數學 第 1 頁共 1 頁

1. The matrix A is as below.

$$A = \begin{bmatrix} 4 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

(1). Find the eigenvalues $\lambda_1, \lambda_2, \lambda_3$. (4%)

(2). Find the corresponding eigenvectors X_1, X_2, X_3 with matrix $X = [X_1 \ X_2 \ X_3]$. (6%)

2. Solve the initial value problem of the following differential equations.

(1). $2y(x^2-1)y' + (y^2+1)\ln|y^2+1| = 0, y(3) = 1$ (10%)

(2). $x^2 y'' - xy' + 4y = \cos(\ln|x|) + x \sin(\ln|x|), y(1) = 1, y'(1) = 2$ (10%)

(3). $y' + (x+1)y = e^{x^2} y^3, y(0) = 4$ (10%)

(4). $y''' - 9y'' + 27y' - 27y = 54 \sin 3x, y(0) = 1, y'(0) = 2, y''(0) = 3$ (10%)

3. Find the solutions of the following differential equations by use of Laplace transforms.

(1). $y'' + 4y' + 3y = \sin(t-1)u(t-1) + e^{-2t}\delta(t-2), y(0) = 0, y'(0) = 0$ (10%)

(2). $y(t) + \int_0^t y(\tau) \cos(t-\tau) d\tau = tu(t-1) + e^{-2t}$ (10%)

(3). $\begin{cases} y_1' = 4y_1 + 8y_2 + 2\cos t - 16\sin t \\ y_2' = 6y_1 + 2y_2 + \cos t - 14\sin t \end{cases}, y_1(0) = 15, y_2(0) = 13$ (10%)

4. Calculate the following integral of complex functions using Residue theorem

(1). $\int_0^{2\pi} \frac{2\pi d\theta}{2 + \cos \theta}$ (10%)

(2). $\text{pr.v.} \int_{-\infty}^{\infty} \frac{1}{(1+x)(x-2i)^2} dx$ (10%)